Electrical Contracting

MAY
1944

The Magazine of
ELECTRICAL CONSTRUCTION AND MAINTENANCE

HOW'S YOUR VOLTAGE?

You can often iron out difficulties by regulating voltage--and SAVE

New England lab cuts testing time

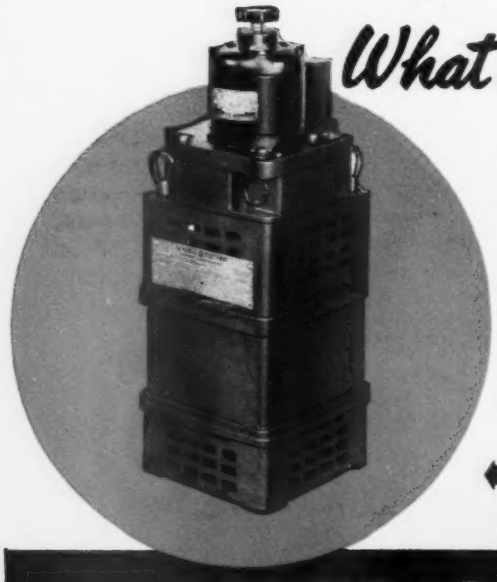
This laboratory, testing electronic tubes and communications equipment, was getting uncertain test results because of a fluctuating incoming line voltage. It was necessary to repeat some tests over and over to assure accuracy. G-E engineers suggested installing three 3.6-kva, 120-volt automatic induction regulators. These regulators now furnish the exact voltage required for each test, and hold it constant throughout the test. Over-all testing time has been cut in two.

Aircraft plant saves—and speeds inspection

A midwestern manufacturer X-rays all propellors before releasing them for duty, to make sure that they are perfect. Considerable time was being lost because of fluctuations in the voltage applied to the X-ray machine. Underexposure or overexposure of X-ray film was the rule rather than the exception. Numerous "retakes" were necessary. This problem was ironed out with an automatic G-E 2.4-kva, 240-volt, induction regulator. Not only was time saved and production increased but the savings in X-ray film alone paid for the regulator in three months.

Western power company saves critical material

A western radio station experienced trouble because varying loads caused voltage fluctuations on the feeder supplying the station with 240-volt, three-wire, single-phase service. For the power company serving this area to install an *independent* feeder, would have required a large amount of critical material, and would have been difficult because of its effect on the station's elaborate antenna counterpoise. This problem was solved by installing a 2.4-kva G-E induction regulator on the *existing* feeder. Voltage regulation is now reported excellent.

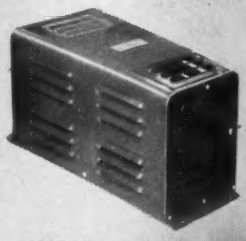


What is your problem?

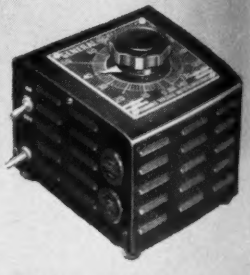
Pepless motors, poor lighting, uncertain test results, and production slumps are often the result of poor voltage. Whether you need voltage control for an electronic tube or a power shovel, there's a simple, economical G-E device for the job. Ask your G-E representative for further information. *General Electric Company, Schenectady 5, N. Y.*

Motor-operated regulator typical of sizes 3.6 kva and smaller. For automatic operation, control panel is furnished separately.

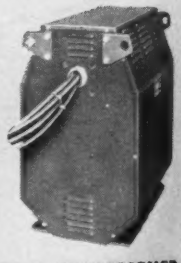
OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.



VARIABLE-VOLTAGE AUTO-TRANSFORMER—Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.



TYPE D TRANSFORMER—For insulating lighting circuits, reducing light flicker, boosting or stepping down voltage for the most economical operation of motors, welding equipment, etc. Ratings up to 100 kva, 600 volts.

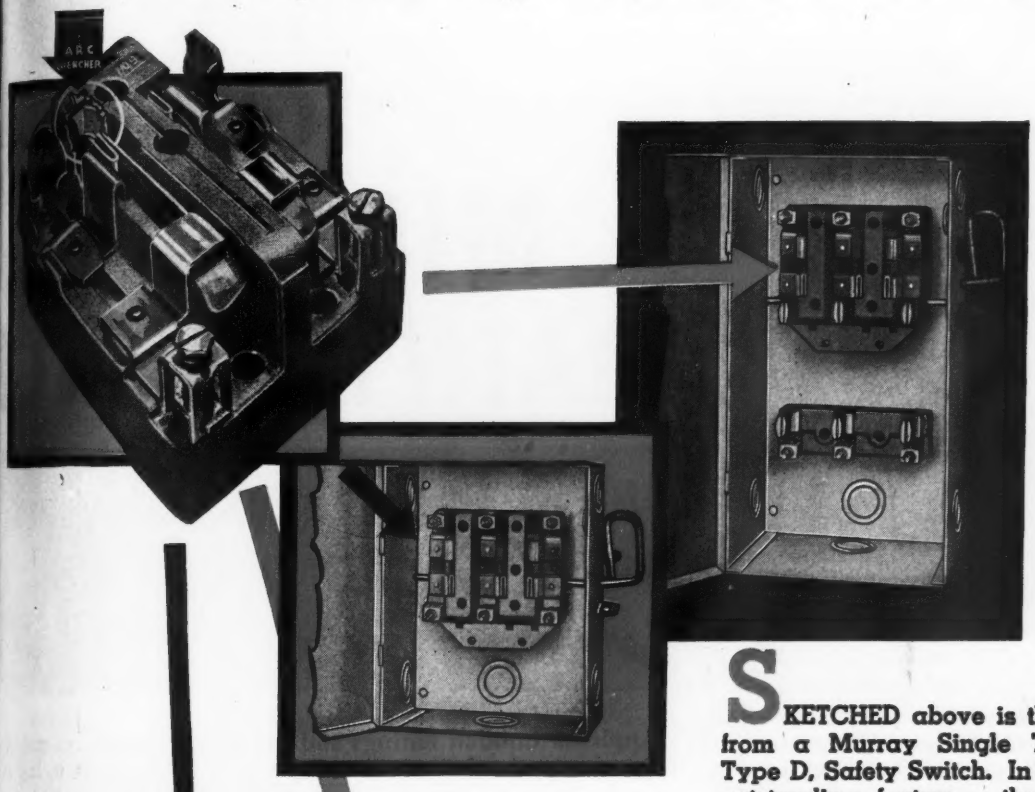
THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB **BETTER**

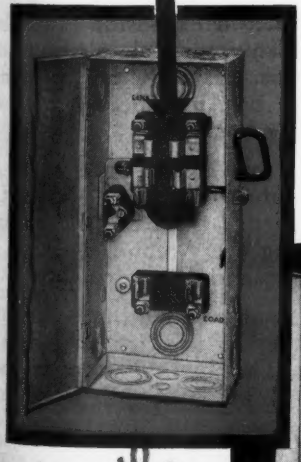
GENERAL ELECTRIC

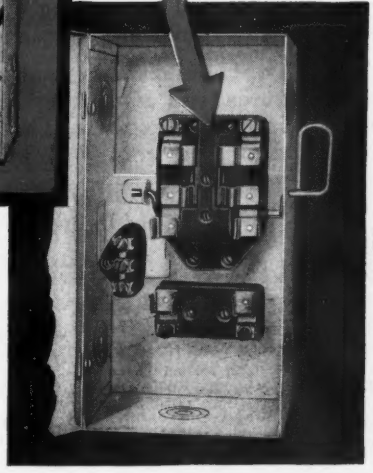
493-66-5205, 5400

"A FIRST CLASS INSTALLATION", *say electricians*

(*and they also say,* "SO EASY TO PUT IN")







Arc-quenching construction in 2, 3 and 4 Pole, 30, 60 and 100 Ampere Safety Switches.

SKETCHED above is the switch block from a Murray Single Throw, Fusible, Type D, Safety Switch. In the circle is the outstanding feature — the double break blade and arc quenching chamber.

Each blade is provided with a double break — the arc is broken into two parts. The burning is greatly reduced by this feature. Whatever arc is formed at each of the two breaks is drawn into a narrow slot in the mounting base where it is lengthened-out and cooled — the effects co-acting to quench the arc almost instantly.

This arc-quenching construction coupled with those Murray Switch characteristics as ample wiring room, properly placed knockouts, good-looking cabinets, assure the electrician the satisfaction that comes from a first-class installation. Metropolitan Device Corporation, Brooklyn, New York.

Write for the facts — no obligation!

Murray

SAFETY SWITCHES

THERE ARE MURRAY JOBBERS EVERYWHERE

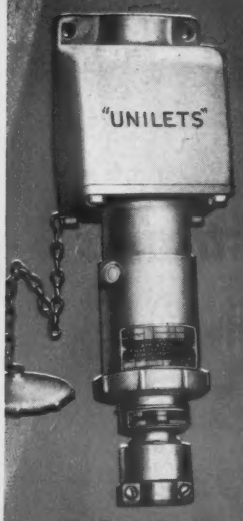
Keep On

BUYING WAR BONDS AND STAMPS

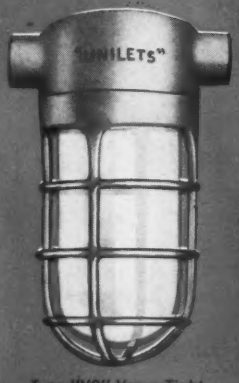
ELECTRICAL CONTRACTING. Published monthly, price 25 cents a copy. Vol. 43, No. 5. Allow at least ten days for change of address. RETURN POSTAGE GUARANTEED. Publication Office, 99-129 N. Broadway, Albany, N. Y. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd St., New York 18, N. Y. Subscription Rates—U. S. A. and Latin American Republics, $2.00 a year, $3.00 for two years, $4.00 for three years. Canada $2.50 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions, 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year, $6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. Cable address: "McGraw-Hill, New York." Member A. B. P. Member A. B. C.

Skillfully Designed Ruggedly Built

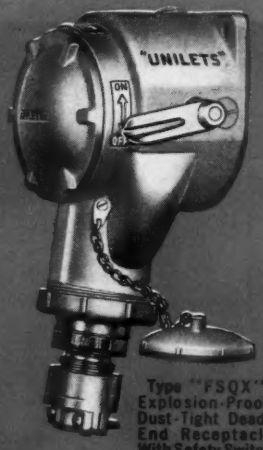
for MINIMUM MAINTENANCE



Type "QEE" Heavy-Duty, Dead-End Receptacle and Plug

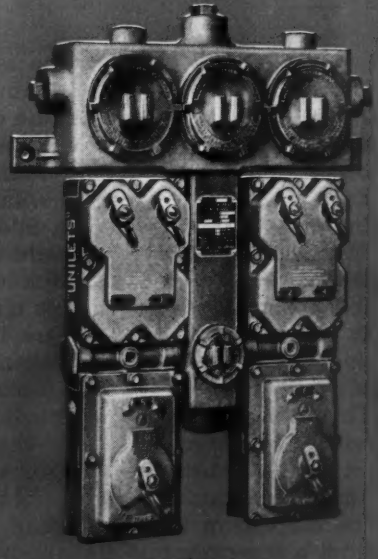


Type "VC" Vapor-Tight Lighting Fixture Form 100—Screw-Type Guard

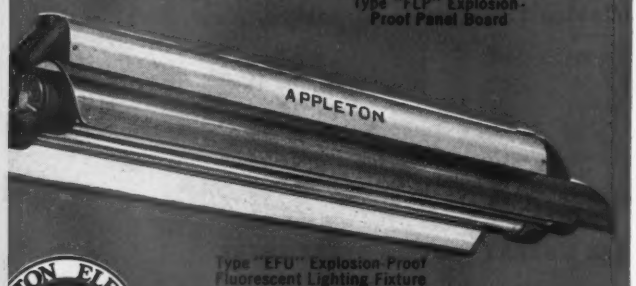


Type "FSQX" Explosion-Proof, Dust-Tight Dead-End Receptacle With Safety Switch and Plug

Type "EVA" Explosion-Proof Lighting Fixture —Pendent Type



Type "FLP" Explosion-Proof Panel Board



Type "EFU" Explosion-Proof Fluorescent Lighting Fixture

HUNDREDS OF APPLETON TYPES MEET EVERY CONDUIT FITTING A LIGHTING FIXTURE REQUIREME

Appleton Conduit Fittings and Lighting Fixtures cut maintenance cost in two important ways—they're sturdily made to last as long as the building where installed, *and* those that may ever require any service are carefully designed for easy accessibility.

For instance, when an Appleton Explosion-Proof Fluorescent Lighting Fixture needs a new lamp, it's a simple matter to remove the screw cover and install one. Easy, low-cost maintenance was given important consideration by Appleton engineers when the design was still on the drawing boards.

Lower cost of installation, too, is characteristic of Appleton equipment—from simplest conduit fittings and lighting fixtures to big explosion-proof panel boards—types and sizes running into many thousands and blanketing every requirement. All are skillfully planned for quick hook-up and easy wiring.

You not only build for permanence with Appleton fittings and lighting fixtures, you also pave the way for long years of rock-bottom maintenance expense. That double advantage means lasting satisfaction and good-will on every job where you install Appleton equipment.

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY
1704 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

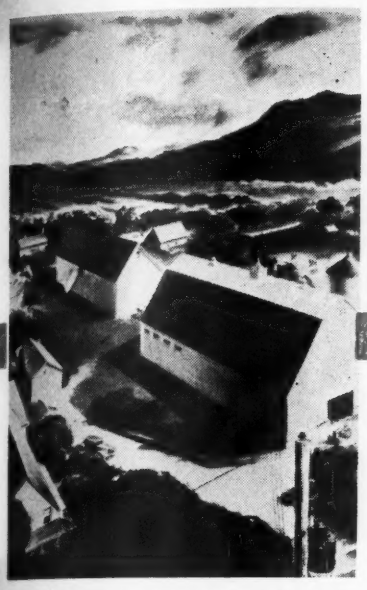
Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 175 Luckie Street, N. W. • BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth Street, S. • PITTSBURGH, 418 Bessemer Bldg.

Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle.

APPLETON ELECTRIC PRODUCTS REG. U.S. PAT. OFF.

APPLETON

CONDUIT FITTINGS · OUTLET AND SWITCH BOXES · EXPLOSION-PROOF FITTINGS · REELITES



OUR COVER this month is "Electricity on the Farm," the ninth in a series of original sketches of electrical equipment in wartime by Artist Stephen Grout.

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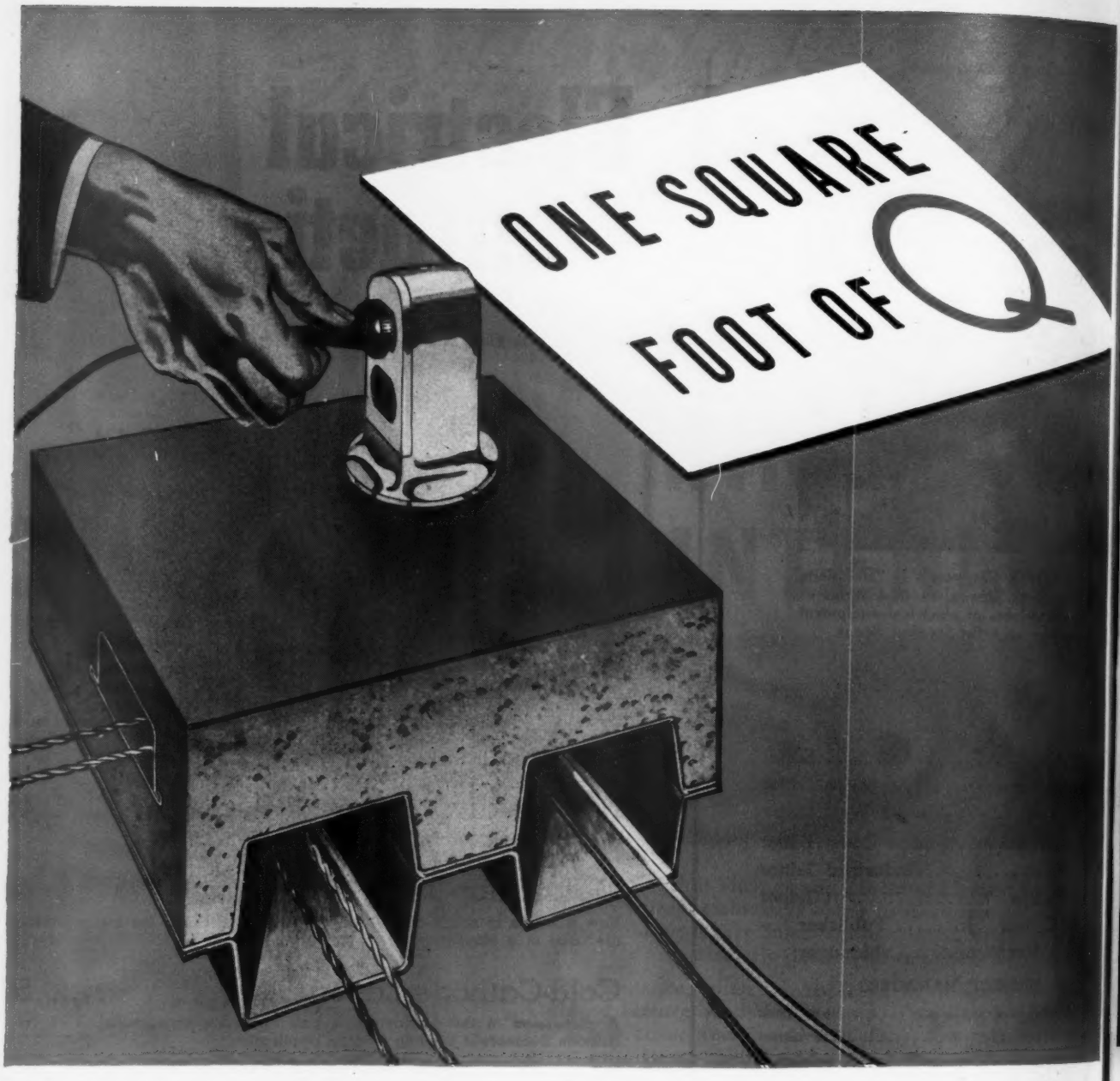
A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

Electrical Contracting

With which is consolidated The Electrologist and Electrical Record. Established 1891

Contents for MAY, 1944

Departments



This is a square foot of Q-Floor . . . a lot *more* than floor space. If every square foot of floor under you were Q-Floor, you could drill anywhere, anytime and set up an electrical outlet.

Q-Floors are designed to meet change. And what floor doesn't face change—or obsolescence?

This means, if tomorrow a desk is to be moved with its lights, telephone, signal system, business machines, to any other spot on the floor, you can quickly install new electrical outlets exactly where you want them. Or you may move production machinery, one machine or a battery, and tap power from any spot on the floor. Every square foot of Q is always *electrically alive.*

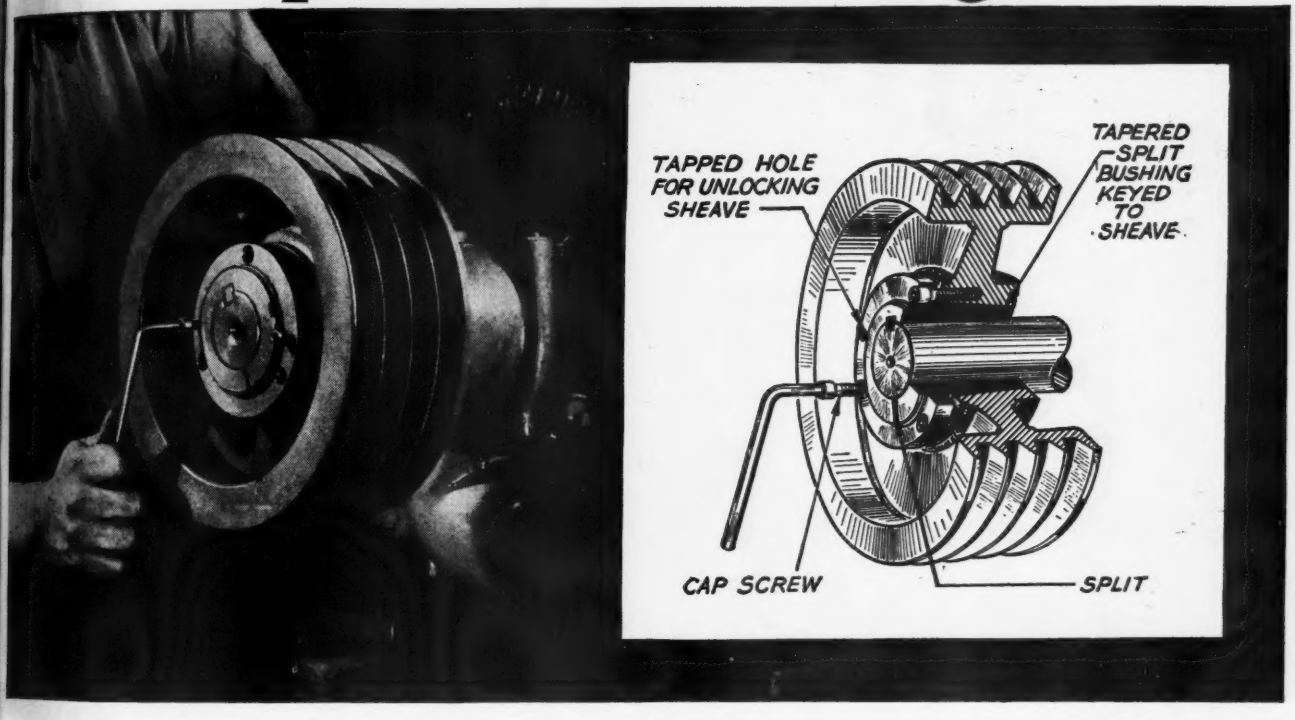
There will be no trenches in the floor, no muss. The entire operation, from drilling to plugging in, takes only minutes. Q-Floors are adaptable to all types of wiring covered by the National Electrical Code.

Before you plan postwar construction, get in touch with your nearest General Electric Merchandise Distributor. He'll be glad to send Q-Floor literature.

H. H. ROBERTSON COMPANY • Farmers Bank Bldg., Pittsburgh, Pa.

ROBERTSON Q-FLOORS

It's Smoother Running because it "Grips like Magic!"



...And it's the fastest mounting sheave on the market—goes on with one easy locking operation—saving man-hours and money.

POSITIVE clamp fit of Allis-Chalmers' great new "Magic-Grip" sheave means shafts are gripped tightly and uniformly...eliminating wobble and shear!

Its tapered split bushing makes it possible for anyone to mount or remove sheave quickly and easily — an important worker-safety feature. Accommodating normal shaft tolerances, the sheave that "grips like magic" may be changed often without injury to shaft.

And you get the great new "Magic-Grip" sheave... *at no increase in price!* Now, more than ever, it pays to make Allis-Chalmers your "V-Belt Headquarters."

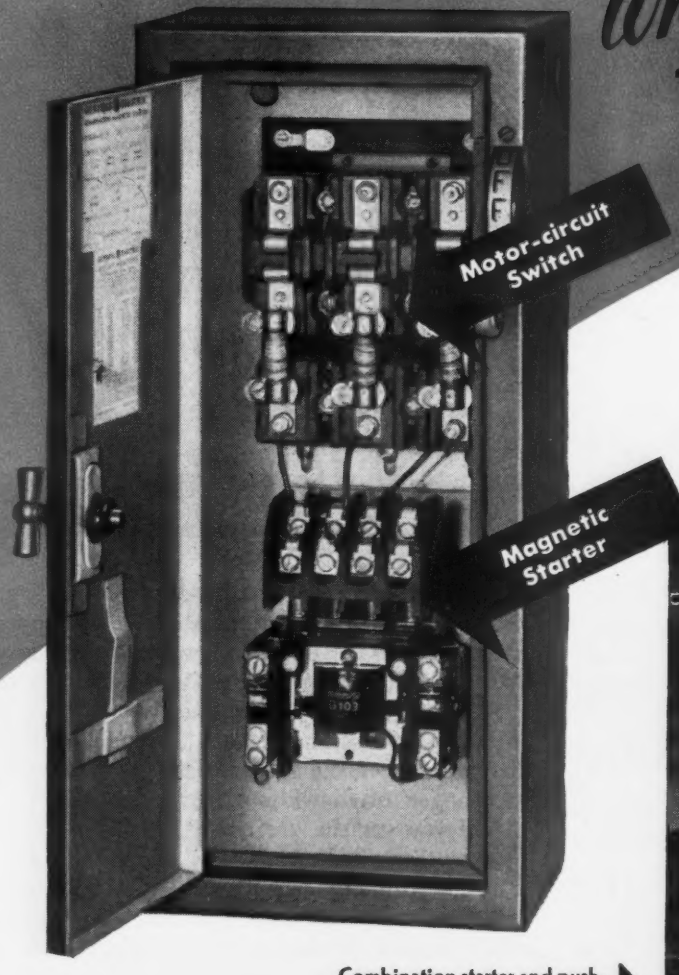
For complete information, ask our nearest district office or Texrope dealer for Bulletin B6310. Or write ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1681

Allis-Chalmers Texrope "MAGIC-GRIP" SHEAVES

You can save time and space

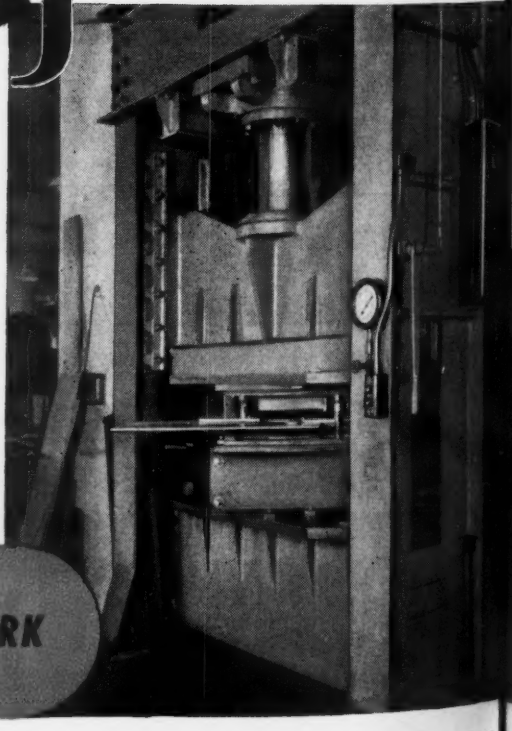
ONE COMPACT

Why two devices? ONE



COMBINATION STARTER

Combination starter and push-button station on a press



G-E COMBINATION STARTERS AT WORK

gain greater protection too

UNIT

FOR MOTOR CONTROL AND PROTECTION

can do the job.

YOU no longer need buy a separate device for each function of motor control. Now you can get *combination* control—in a *variety of enclosures* to meet every operating condition. This control combines a motor-circuit switch and a magnetic starter in one, compact, easy-to-mount unit.

By using these starters you profit five ways:

1. Quick Selection—By ordering *one* factory co-ordinated unit instead of two, you can save time. You just specify the motor rating and indicate the type of motor-circuit switch you want and the type of application you have in mind—we'll send you the starter you need.

2. Reduced Installation Time—Users of combination starters report a 50 per-cent reduction in mounting time and a 40 per-cent reduction in wiring time.

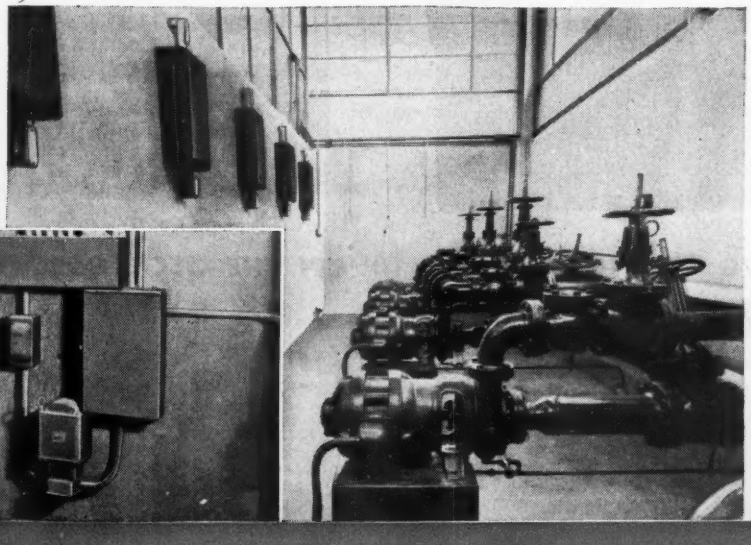
3. Motor Protection—With G-E combination starters, you're sure that the rating of the motor-circuit switch or breaker matches that of the magnetic starter with which it is to be used. The co-ordination of thermal overload relays with the fuses or breakers affords complete motor overcurrent protection under any condition of operation.

4. Greater Safety—The motor-circuit switch, being in the same case with the magnetic starter, is mechanically interlocked with the cover. Thus the cover cannot be opened while there is power on the starter.

5. Less Space Required—Combination starters take less mounting space than separately mounted safety switches and starters.

These starters are also available for high-voltage starting. For further information on combination starters write to your local office for Bulletin GEA-3715. *General Electric Company, Schenectady 5, New York.*

Combination starters (on wall at left) installed in a pump room



For reliability of operation, combination starters with dust-tight enclosures in a grain elevator

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

676-131-8930

new... ELECTRONIC

Confirms Ability of Insulation to Withstand Shorts Due to Voltage Surges

● Now, a new electronic test shows visually that the insulation of every coil, every turn, and every phase of a G-E Tri-Clad motor winding has the strength to withstand the voltage surges that are a cause of shorts and grounds in service. Thanks to this new G-E development, no undisclosed insulation weakness can "get by."

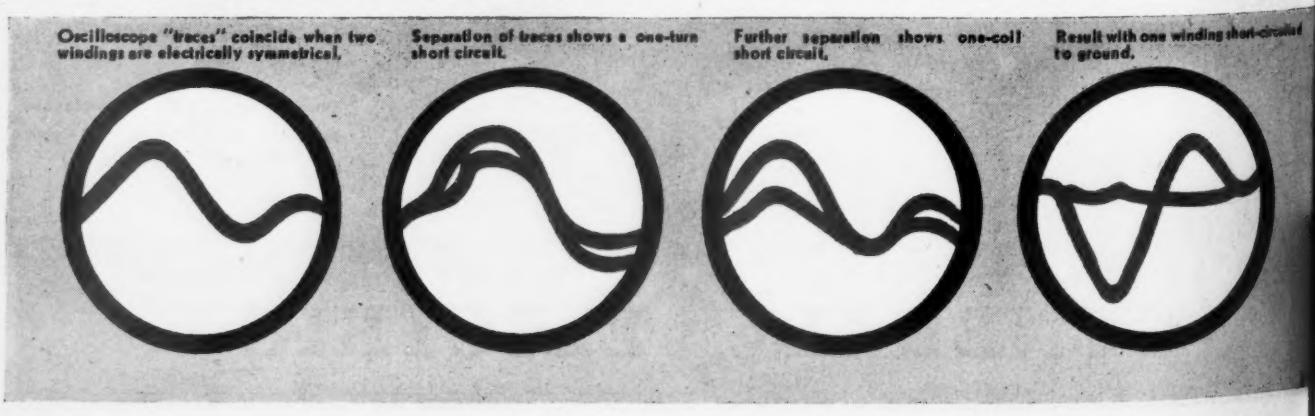
The new test method* subjects each coil in the assembled motor to a steep-front surge impulse, similar to a high-voltage transient of actual service. A cathode-ray oscilloscope indicates the performance of the winding under this sudden stress.

Only a motor with perfect insulation, and with the phases symmetrical, will give a single, clear-cut "standing wave" on the screen. The test indicates not only the condition of turn-to-turn insulation, but also that of coil-to-coil and coil-to-ground insulation.

This test is now applied to all G-E Tri-Clad motors, and to many other G-E motors and generators, as a regular step in production. Its advantages are so great that its use is widening throughout the motor industry.

*For complete details, see "Insulation Testing of Electric Windings," Trans. of A.I.E.E., Vol. 62, pp. 203-206.

HERE'S HOW WINDING STRENGTH SHOWS UP ON THE OSCILLOSCOPE "WINDOW"



TEST Tells the "Inside Story" of Motor Windings

Production-line test of G-E Tri-Clad motors with new electronic tester. Operator turns transfer switch to take reading on each phase.

An Individual Check of Each TRI CLAD Motor Gives Extra Assurance of Unfailing Service

At each Tri-Clad motor factory, a production-line test setup like the one shown above is regularly in service. The motor windings are checked by this new test as an *additional* step in G.E.'s strict testing procedure. Other winding tests include the high-potential and high-frequency tests, in addition to many quality tests made on Formex* wire and other winding materials before they are used in the motor windings. Whenever you buy or specify a G-E Tri-Clad motor for your plant or machine, you get extra assurance of unfailing service. *General Electric Company, Schenectady, N. Y.*

*Reg. U. S. Pat. Office.

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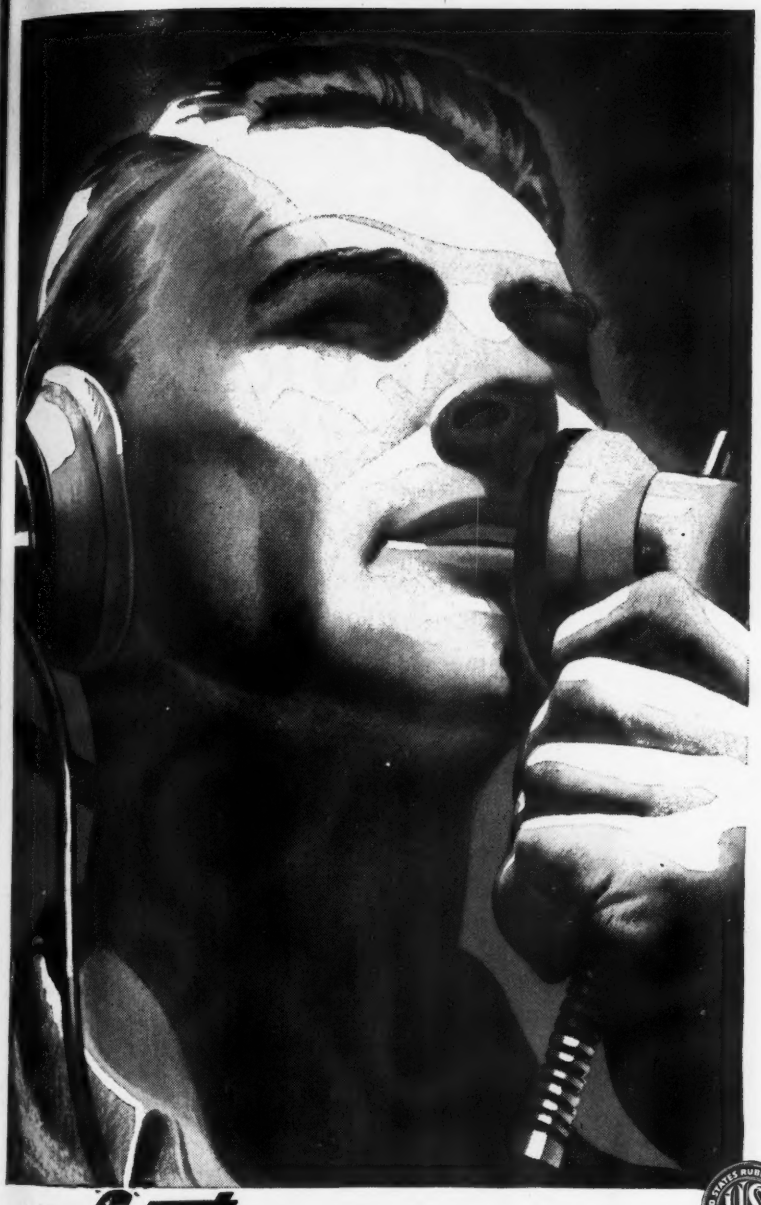
GENERAL ELECTRIC

750-234-8030



"FIGHTING WORDS"

—TAKE A LOT OF WIRE!

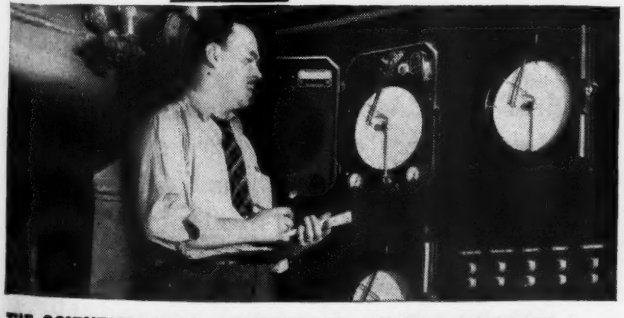
The ease with which wires and cables can be handled, speed with which they can be installed and readiness with which they can be maintained are tremendously important in battle-zones.

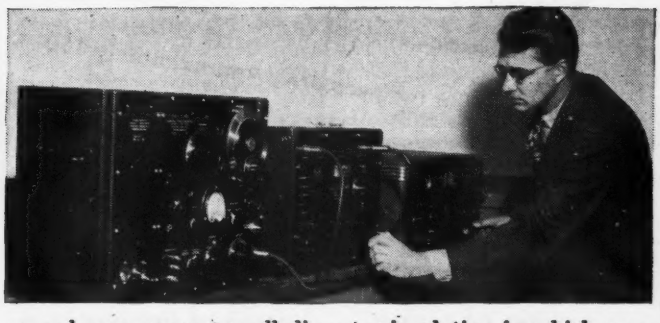
To get these advantages, the Signal Corps developed wires and cables having appreciably smaller diameters, with corresponding reductions in bulk and weight. Working in close cooperation with Signal Corps Engineers, U.S. Rubber Company engineers contributed the Laytex process.

Long before the war, this process was used for insulating small diameter wires for building, commercial and control circuits. The Laytex process made possible the famed lightweight Laytex Assault Wire of front line use, and has been adapted to a wide variety of other wires and cables for Ordnance, Corps of Engineers and the Navy.

When the day comes that we can again make peacetime versions of these smaller diameter wires and cables they will bring you extra advantages in meeting the increased capacity requirements of the vast new wiring, re-wiring and re-conversion markets. Smaller wires will save shipping and storage space—handling and installation will be easier.

Laytex WIRES AND CABLES — **SERVING THROUGH SCIENCE**





THE SCIENTIFICALLY CONTROLLED LAYTEX PROCESS is an exclusive method of (1) specially preparing and compounding wire insulation ingredients, and (2) applying the insulation. Purification operations remove 90% of moisture and water soluble impurities from liquid latex so as to form the basis for insulation of unusually high dielectric strength. Repeated dipping and drying followed by vulcanizing results in building up a homogeneous, small diameter insulation in which conductors are perfectly centered. The process is adaptable to the use of synthetic rubbers as well as natural rubber. In either, the insulation is compounded to resist extremes of temperature, from tropical heat to sub-zero cold. Evidence of this property is the global use of Laytex wires and cables by our Armed Forces.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE, ROCKEFELLER CENTER, NEW YORK 20, N. Y. • In Canada: DOMINION RUBBER CO., LTD.

NEW! Fibron ALL-PURPOSE TAPE

FOR INSULATING wires, cables and electrical equipment . . . **FOR PROTECTING** electrical wires and cables exposed to caustic or corrosive fumes, oil, grease, acids, alkalies, or moisture...**FOR SPLICING** cables with a continuous, protective covering . . . **FOR COVERING** exposed piping in chemical plants, equipment exposed to moisture or severe atmospheric conditions.

These widely diversified applications of FIBRON TAPE No. 1 are made possible by its combination of outstanding electrical, physical, and chemical properties. (See adjacent panel.) This *flexible, elastic,* "Vinylite"* resin tape is heat sealing, flame resistant, high in dielectric strength, strong mechanically, and highly resistant to oils, acids, alkalies, moisture, and normal variations in temperature and climate.

FIBRON TAPE is a new addition to the already extensive line of Irvington products. It is offered with the usual guarantee that applies to all Irvington Insulation — to protect equipment in accordance with specifications.

Plan now to test the new FIBRON TAPE. A generous sample will be sent on request — without obligation. For further information on FIBRON, or other IRVINGTON INSULATION, write Dept. 96.

*Reg. Trade Mark—CARBIDE & CARBON CHEMICALS CORP.

OUTSTANDING PROPERTIES
FIBRON TAPE No. 1

Tensile strength	1700 lb. per sq. in.
Dielectric strength	1000 VPM (.012")
Low temperature flexibility	-40° C.
Elongation	250% — 400%
Power Factor @ 30° C. (60 cycles)	—6.5%
	(1 kilocycle)—6.2%
Dielectric Constant @ 30° C. (60 cycles)	—7.6%
	(1 kilocycle)—6.9%
Bonding temperature	Approximately 150° C.

IRVINGTON for INSULATION

EXTRUDED PLASTIC TUBING — VARNISHED TUBING
INSULATING VARNISHES — VARNISHED RAYON
VARNISHED PAPER — VARNISHED FIBERGLASS
VARNISHED CAMBRIC — VARNISHED SLOT INSULATION
VARNISHED CANVAS AND DUCK — OIL STOPS
VARNISHED AND PLASTIC WIRE MARKERS

STANDARD OF THE WORLD — IRVINGTON INSULATION — TRADE MARK U. S. PAT. OFF.

IRVINGTON VARNISH & INSULATOR COMPANY
6 Argyle Terrace, Irvington 11, New Jersey, U. S. A.
Plants at
Irvington, New Jersey and Hamilton, Ontario, Canada
Representatives in 20 Principal Cities

IRVINGTON *Electrical* INSULATION

THE SYMBOL OF COLLABORATION FOR *Quality* AND *Progress*

Pioneers in industrial lighting for 21 years, members of RLM Standards Institute have worked together to give deep significance to the RLM Label. It has come to symbolize (1) Engineered Lighting, (2) Economy through More Light At No Extra Cost, (3) Low Maintenance Cost. It is instantly recognized by buyers that industrial lighting fixtures bearing the RLM Label provide these vital advantages.

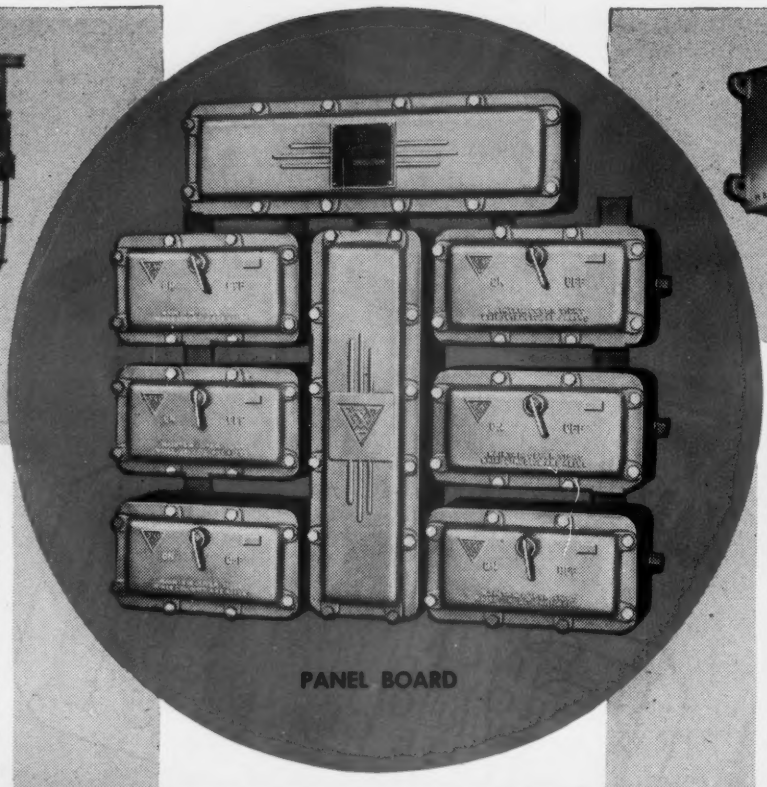
The RLM Standards Institute does not manufacture lighting equipment. It is a non-profit organization. It operates to develop and promulgate standard specifications for the efficient performance of industrial lighting equipment. Official Standard of RLM Specifications . . . available through manufacturers utilizing RLM inspection and certification, or direct from RLM Standards Institute . . . provide dependable guidance on vital construction and performance factors for both Incandescent and Fluorescent Lighting Units. They are trustworthy guides to *efficient* and *effective* industrial lighting.

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

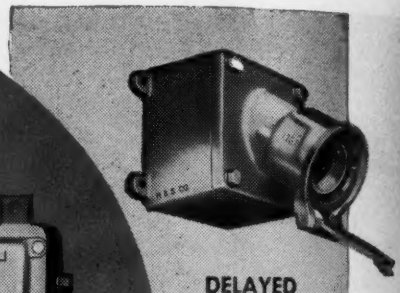
RLM STANDARDS INSTITUTE
INCORPORATED

307 N. MICHIGAN AVE. • SUITE 1600 • CHICAGO 1, ILLINOIS

LIGHTING FIXTURES

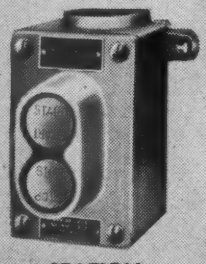


PANEL BOARD

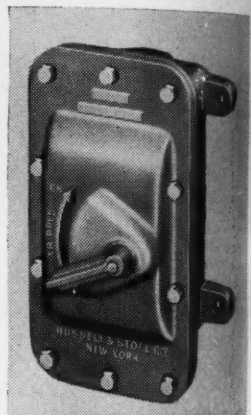


DELAYED ACTION

PUSH BUTTON



STATION



CIRCUIT BREAKER

ELECTRICAL SAFETY . . .

in Hazardous Locations

Since 1902
the
standard for
CHEMICAL
FOOD
MARINE
POWDER
REFINERY
TEXTILE
and all outside installations

That is what R & S fittings and fixtures have achieved since 1902. As industry expanded, resulting in greater volumes of industrial dust, new processes and ever larger hazardous areas, R & S pursued a policy: "If we don't have it, we'll make it."

The result is a single catalog of 300 pages of the largest and most complete line of fixtures and fittings designed exclusively for the hazards of moisture, liquids, dust and gases of all kinds.

You may not need a delayed action switch, or a light that will work under water, but most of the industrial, outdoor and marine jobs you are considering should be protected against moisture, dust or explosive gases for a life-time with R & S products.

If you make electrically operated equipment that is to work under these hazards, it should be equipped with R & S products before it leaves your plant.

Leading electrical jobbers, engineers and contractors have the latest R & S Catalog (No. 90), and can give you good service and good advice.

RUSSELL & STOLL COMPANY
EXPLOSION-PROOF WATER-TIGHT AND EVER-LOK RECEPTACLES, PLUGS, CONNECTORS, SWITCHES AND FIXTURES
125 BARCLAY STREET • NEW YORK 7, N. Y.

This label means a SERVICE that *protects* you

ON FLUORESCENT FIXTURES

FLEUR-O-LIER is a *testing* and *certification* service in which over 30 leading fluorescent lighting fixture makers participate. Here's what it means to *you:*

- ★ **Dependable, trouble-free operation.**
- ★ **Fixtures made to 50 definite standards . . . and**
- ★ **Tested by Electrical Testing Laboratories, Inc., of New York.**
- ★ ***Certified* by E. T. L. as meeting the 50 standards.**
- ★ ***Certified* ballasts and starters in every unit.**

Whether you're a user or supplier, the FLEUR-O-LIER Label on a fixture assures dependability, service and protection for you. Insist on it when you specify fluorescent lighting equipment.

FLEUR·O·LIER *Manufacturers*

2122-5 KEITH BUILDING, CLEVELAND 15, OHIO

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

H&H

DURABLE

DEPENDABLE

SWITCHES

POWER-

LIGHT

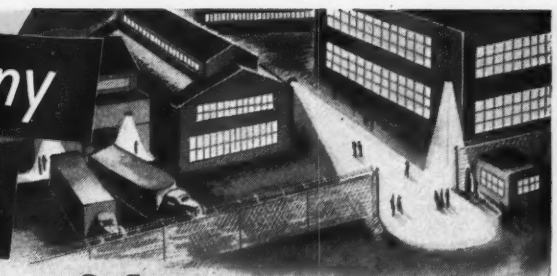
DISTRIBUTED THROUGH
ELECTRICAL WHOLESALERS

"Hot wires", heavy loads, round-the-clock operating schedules, — these demand super-stamina in switches. *These are the switches!* — HEAVY-DUTY CONTROLS FOR LIGHTING OR POWER CIRCUITS IN INDUSTRIAL PLANTS. Specification-grade T-rated 10, 20 and 30 Ampere "Type C" Switches, Rotary Snap Switches, Ceiling Pull Switches, Door Switches, Flush Tumbler Switches with or without outlet box covers. Mechanisms long-tested and singled out for the *peak* performance now so necessary. Pick them for flawless service on the critical jobs.

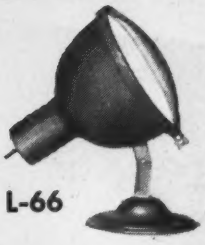
HART & HEGEMAN DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U.S.A.

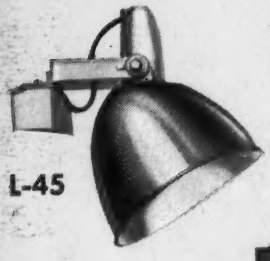
Which–Where–How Many for daylight after dark?



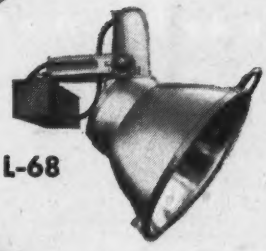
G-E TECHNICAL ASSISTANCE CAN HELP YOU MAKE MOST EFFECTIVE USE OF NOVALUX FLOODLIGHTS



L-66

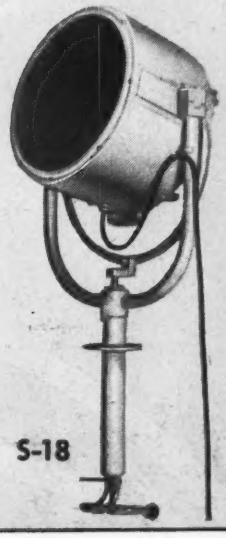


L-45

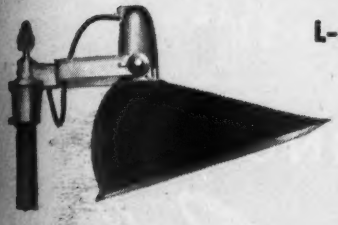


L-68

L-38



S-18



L-46

L-30

L-43, L-49

A few of the more popular NOVALUX FLOODLIGHTS

TYPE	WATTAGE	GENERAL CLASSIFICATION	APPROXIMATE* PRICE RANGE
L-66	200	General Purpose	$12.50
L-38	200/250	Heavy Duty General Purpose	$43.00
L-49	300/500	General Purpose	$27.00 to $40.00
L-30	300/500	Heavy Duty General Purpose	$68.00
L-43	750/1000	General Purpose	$31.00 to $50.00
L-45	750/1500	Area Floodlight	$17.00 to $25.00
L-46	750/1500	Area Floodlight	$28.00 to $36.00
L-68	750/1500	Area Floodlight	$31.00 to $74.00
S-18	900/1500	Searchlight	$200.00 to $320.00

**List prices subject to your usual discount.*

The problems of floodlighting for outdoor production or protection are often such that choice of the right units for the right installation points calls for highly experienced installation guidance.

No matter what the problem may be, G-E lighting specialists can help you decide *which lights to use* and *how to install them.* And whether the job calls for one light or a thousand, you will find what you need in G-E Novalux floodlights—lights with the correct wattage, beam angle, and construction for effective illumination and economical operation.

Take advantage of these efficient, high-quality fixtures, and of the technical service back of them. For full information on *both,* get in touch with the nearest G-E office or authorized agent. *General Electric Co., Schenectady 5, N. Y.*

NOVALUX
Floodlights

GENERAL ELECTRIC

451-91-3200

BUY WAR BONDS

FLOODLIGHTING

Protection

Where there is a Need for Floodlighting There's a Sale for Automatic Control....

SANGAMO TIME SWITCHES

• There are types to meet every protective lighting control need. The complete line includes Astronomic Dial, Synchronous Carry-Over, and Outdoor Time Switches. Form VSW2 Astronomic Dial Time Switch is shown above. Current interruptions up to 10 hours will not stop it nor affect its "on" and "off" settings.

Anybody can make a mistake and that is just where errors can creep in when floodlighting is not automatically controlled. Some of your customers using floodlighting may be depending on the human element for "off" and "on" control right now. Remember that they bought floodlighting for full protective value from the moment of sunset to sunrise.

You can show these customers and new ones to whom you will sell floodlighting, that SANGAMO TIME SWITCHES eliminate all chance of error in turning the floodlights "on" and "off". Our new catalog will better acquaint you with this sales opportunity.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

FOR PRESENT-DAY AND PROPOSED JOBS

Insist On

JEFFERSON ELECTRIC
BALLASTS, TRANSFORMERS, FUSES

For Maximum Performance

Given first rank by experienced electrical and maintenance men for uniform quality of design and construction, Jefferson Electric Transformers, Ballasts, and Fuses invariably are specified when top performance is vital. Minimum attention and maintenance, and long life reliability mean lower overall cost.

Jefferson Electric products are handled by leading wholesalers for your convenience—specify them when ordering.

Ballasts with Bottom Leads save material and time since they may be mounted on narrow wiring channels above the fixture. They are available in the popular capacities: two- and three-lamp, 40 watt; two- and four-lamp, 100 watt.

FLUORESCENT LAMP BALLASTS

Long-hour operation demands the best in fluorescent lighting and the best in Ballasts. Jefferson Electric Ballasts are available for use with all commonly used fluorescent lamps and in single- and two-lamp types. For full data, see new Bulletin 441-FL.

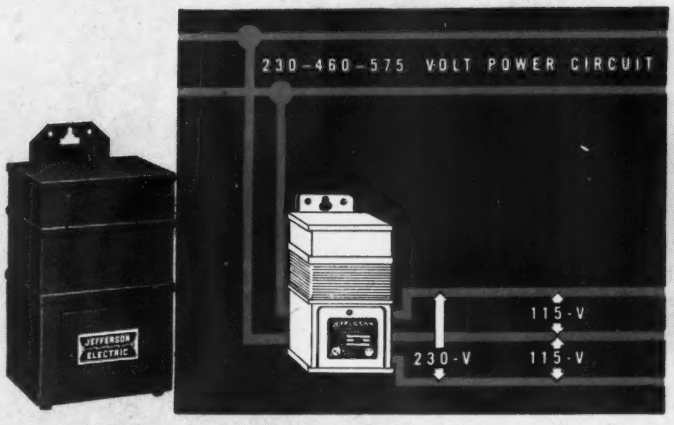
JEFFERSON TRANSFORMERS
FOR MERCURY LAMPS

Correctly designed and coordinated to govern the current through the starting and operating cycles of mercury lamps, Jefferson Transformers meet the most exacting requirements. They insure maintained high efficiency.

Tested and approved by Electrical Testing Laboratories of New York, they are listed also by Underwriters' Laboratories, Inc., and carry the Underwriters' Re-examination Service Label. Indoor and Outdoor Transformers are made in all standard capacities, single- and two-lamp types.

JEFFERSON ELECTRIC

TRANSFORMERS for POWER CIRCUITS



Eliminate duplicate high and low voltage circuits. Distribute only the 230 to 575 volt service—and provide the 115 volt current where needed for lamps, small tools and appliances by means of Jefferson Electric dry type Power Circuit Transformers.

JEFFERSON UNION RENEWABLE FUSES

Proper fusing eliminates unnecessary shutdowns and damage to motors, wiring and equipment. Delays interfere with all-out production.

Jefferson Renewable Fuses provide the safe, reliable protection required. When excessive overloads require these fuses to open the circuit, they do it safely. Their rugged construction and simple design permit quick cleaning and easy renewal.

JEFFERSON ELECTRIC COMPANY • Bellwood (Suburb of Chicago), Illinois

In Canada: Canadian Jefferson Electric Co., Ltd., 384 Pape Avenue, Toronto, Ont.

BETTER LIGHTING

HELPS THOSE WHO ARE FIGHTING

WELL-DISTRIBUTED lighting in a war factory, which gives the worker freedom from glare and shadow, means more tanks and guns and planes for our fighting men at the front.

Today, manufacturers of modern fluorescent lighting units are making more and more use of Masonite* Reflector Shapes. The new, streamlined fixtures are winning a place in modern lighting for essential war work. And manufacturers are finding that these hardboard reflectors have many distinct advantages.

Light weight but extremely durable, Masonite Reflector Shapes are installed quickly, serviced easily. They resist moisture, have very low electrical conductivity, are non-scaling and cannot rust. Fine reflecting coats are easily applied.

You'll want to know more about these shaped reflectors—both for better lighting now and after the war. You'll like their light weight, simple design, rugged strength and the fact that they can be maintained so economically. For more details, write Masonite Corporation, 111 W. Washington St., Chicago 2, Illinois.

MASONITE CORPORATION

Awarded to the Masonite Corp. Plant at Laurel, Miss.

*TRADE-MARK REG. U. S. PAT. OFF. COPYRIGHT 1944, MASONITE CORPORATION

*Continuously-milled rigid steel pipe, twice protected against corrosion by a sherardized zinc coating and a final acid and alkali-proof covering.

will come out of this war tougher and better than ever!

Before the war, Walkerized Dualcote Rigid Steel Conduit had already proved its durability under the worst corrosive conditions. In laboratory tests and in actual use, its superior finish had defied acids, alkalies and salt water where ordinary conduits had failed to stand up.

War has restricted the manufacture of Dualcote for general use. But in its wartime uses, Dualcote has had to withstand the most severe conditions on land and at sea.

Consequently, when wartime restrictions are lifted, you'll find Dualcote conduit even "tougher" and more durable than ever. Its *fighting finish* will be ready to *take it* in chemical plants, dye houses, mines, mills, refineries — or in any other installation that requires a conduit that can defy corrosion!

Ask your local distributor about prices and deliveries. For further information, write to Walker Bros., Conshohocken, Pa.

WALKER Conshohocken

SHEET STEEL ENCLOSURES *for* ELECTRICAL CONTROLS

MADE TO MEET YOUR EXACT SPECIFICATIONS

The Kirk & Blum Fabrication Department is specially equipped to produce custom-built sheet metal equipment for the electrical industry—"tailored" to meet your exact specifications, and fabricated *on* time.

Whatever your requirements—for Cubicles, Control Desks, Switch Gear Housings, etc.—Kirk & Blum's 36 years of experience and modern expanded facilities are your guarantee of obtaining accurately made equipment, at economical cost.

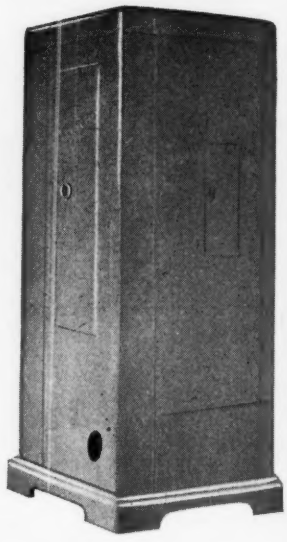
Kirk & Blum facilities, efficiency, and quality standards are held in high esteem by electrical engineers the nation over. That fact is well proved by the widespread use of control equipment fabricated and installed by us.

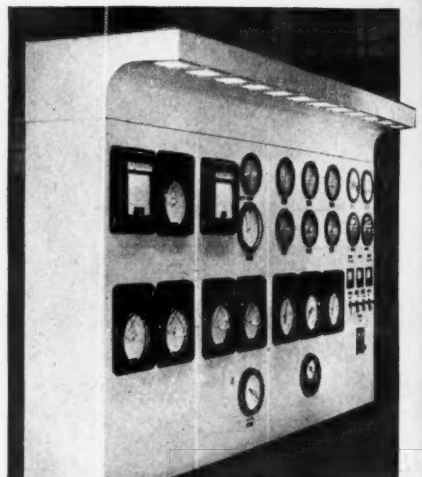
For 100% satisfaction and no regrets—send us your blue prints for prompt quotation. Address The Kirk & Blum Manufacturing Company, 2864 Spring Grove Ave., Cincinnati, Ohio.

Accurate sheet metal fabrication —capacity 3/8″ or lighter

KIRK AND BLUM

AN ORGANIZATION OF ENGINEERS AND MECHANICS

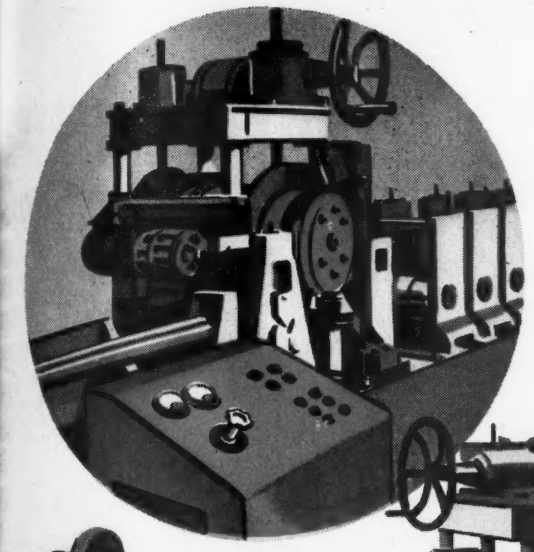


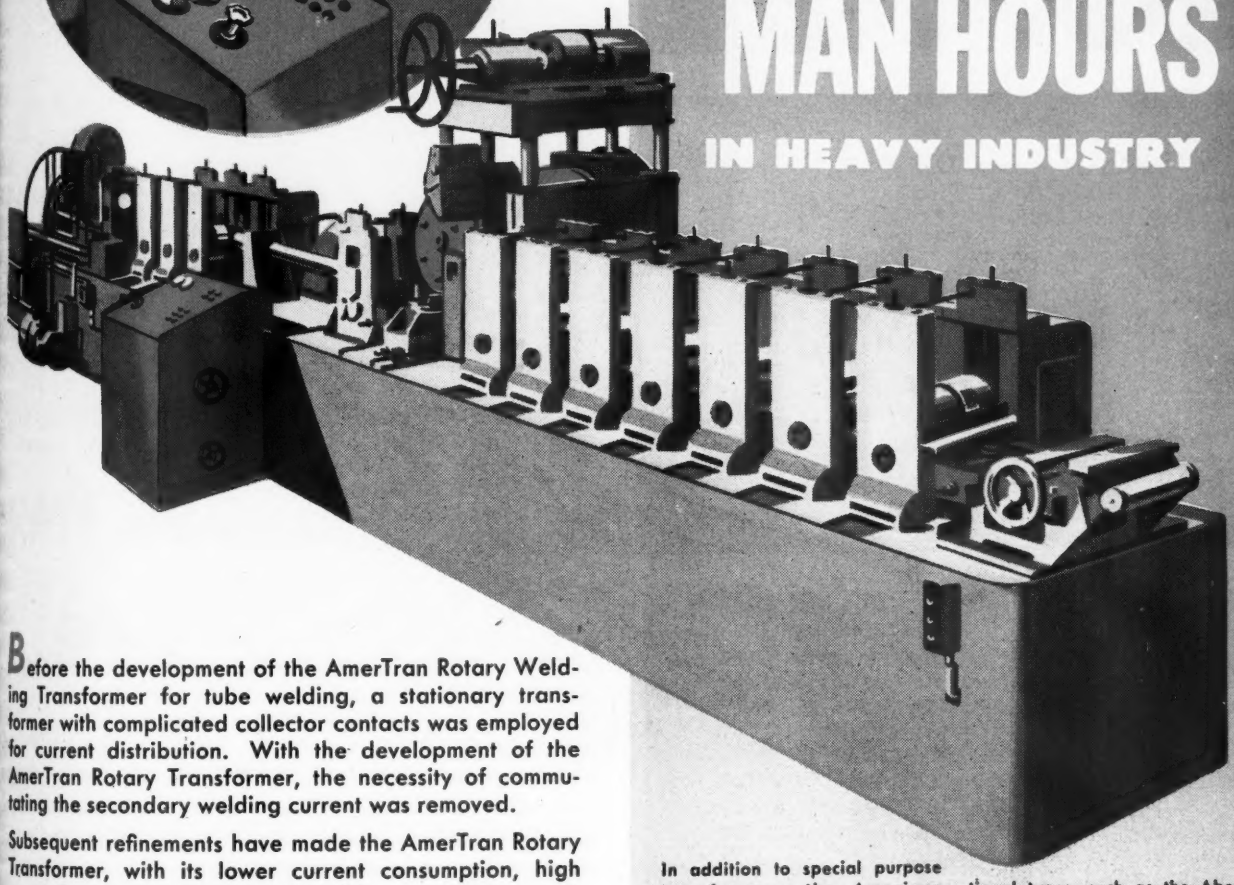


AMERTRAN

FINDS LOST MAN HOURS

IN HEAVY INDUSTRY





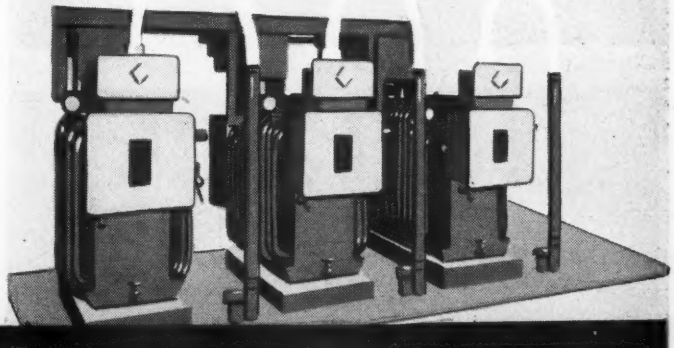
Before the development of the AmerTran Rotary Welding Transformer for tube welding, a stationary transformer with complicated collector contacts was employed for current distribution. With the development of the AmerTran Rotary Transformer, the necessity of commutating the secondary welding current was removed.

Subsequent refinements have made the AmerTran Rotary Transformer, with its lower current consumption, high power factor, small leads and positive non-leaking cooling, a most economical unit. Used in conjunction with the AmerTran Transtat Voltage Regulator, it is a most efficient power supply for tube welding.

This is merely one of the many instances where AmerTran transformer engineering has saved time and cut costs for heavy industries. Our versatile, flexible manufacturing facilities insure the speedy completion of even larger projects. And our long association with radio, as well, assures authoritative design and engineering service for your electronic control and rectifier needs. Write us today, outlining your problems.

AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark 5, N. J.

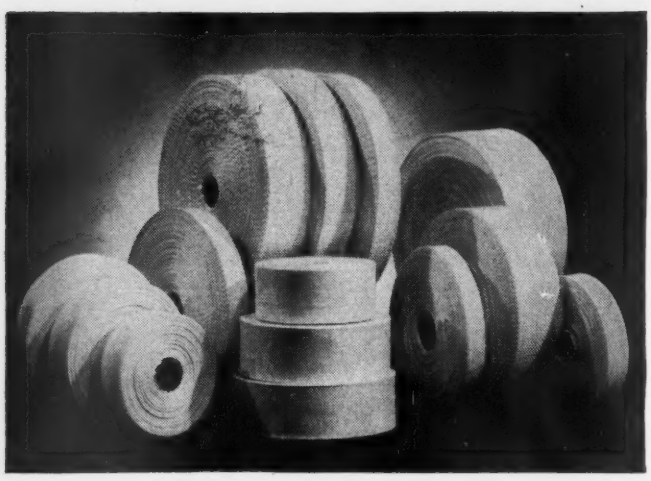
In addition to special purpose transformers, the American Transformer Company manufactures a wide range of conventional types, such as the Abestol Immersed Distribution Transformers shown below.

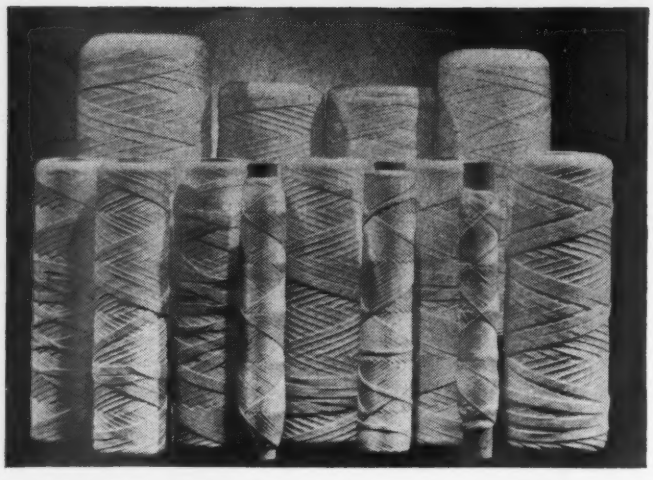


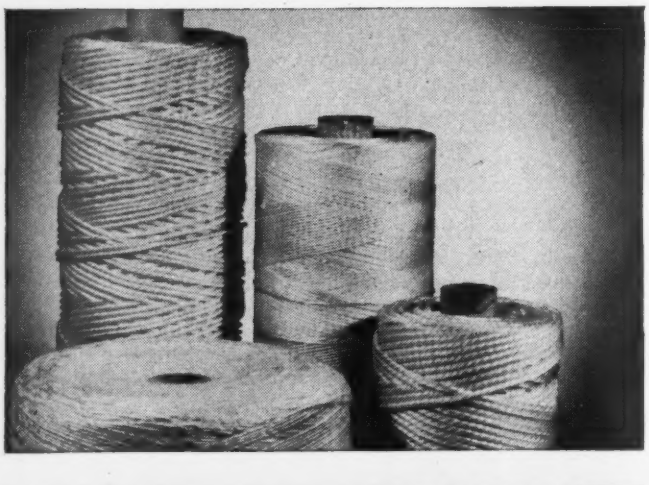
Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.







Fiberglas* properties

—helpful in solving problems in electrical insulation

Fiberglas is glass. It will of itself withstand temperatures far in excess of any requirements of an electrical insulation. But high heat resistance is only one of its many basic properties.

Low space factor (thinness) combined with high tensile strength make Fiberglas highly desirable in many applications in which its high-temperature characteristic has value only as a safety factor . . . In textile form, Fiberglas is available in thicknesses down to 2 mils (.0020″).

Fiberglas is resistant to moisture, most acids, oils, corrosive vapors. Again, these properties make it highly desirable for electrical use where high heat resistance is important only as a safety factor.

In textile form, Fiberglas is a good conductor of heat. This property also permits its use in many electrical applications.

And, of course, Fiberglas is permanent. It does not deteriorate with age.

Treated and Untreated Forms

Untreated Fiberglas is available as cloth, tapes, sleeving, and cord.

In treated forms, Fiberglas is available as varnished cloth and tapes; combination Fiberglas-and-mica sheets and tapes; pressure-sensitive tapes; single, double, and triple saturated sleeving; varnished tubing; and laminated Fiberglas sheets, sticks, or wedges.

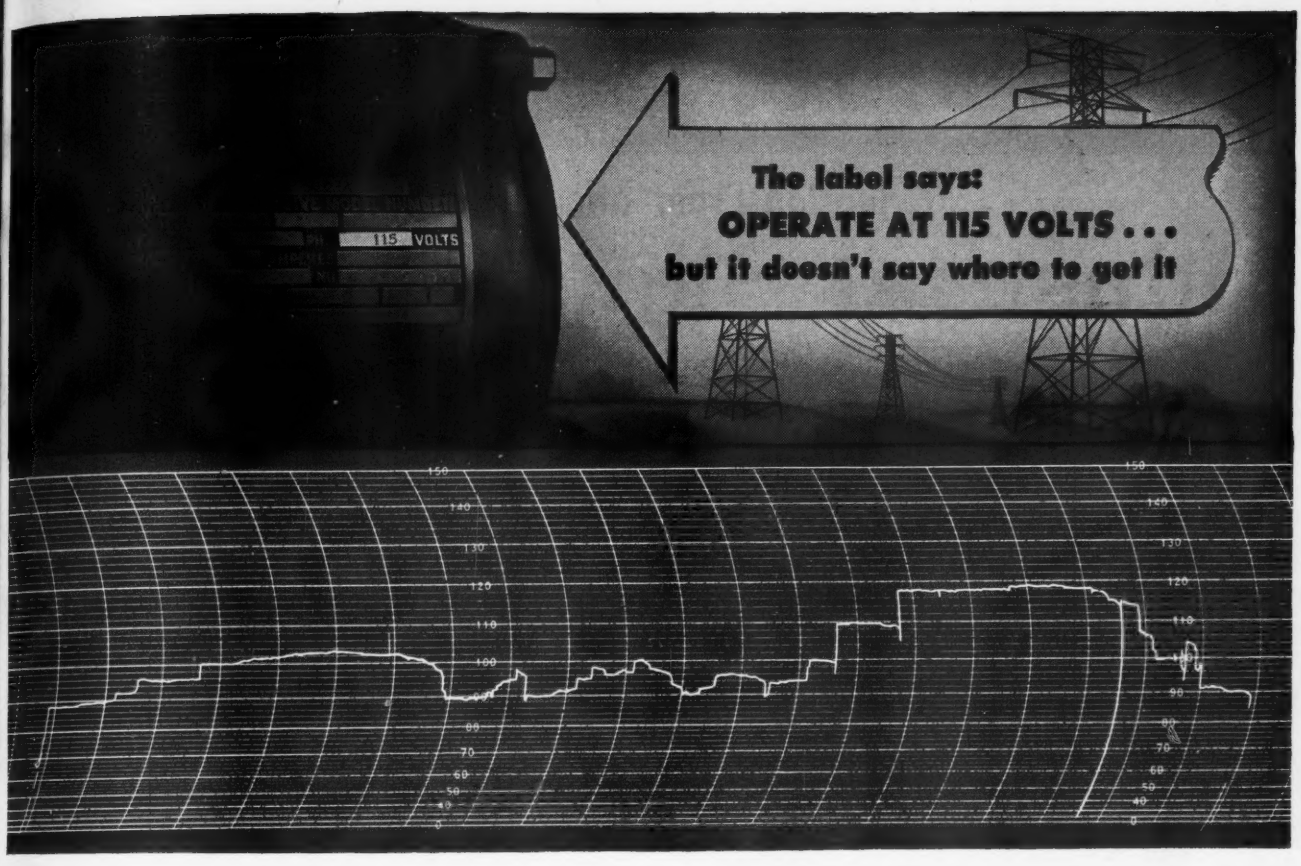
Fiberglas-covered magnet wire, lead wire, and other wires are obtainable from leading wire manufacturers.

Fiberglas is now available for immediate delivery. Increased production facilities make this possible. Consult your electrical distributor. *Owens-Corning Fiberglas Corporation, Toledo 1, Ohio, Fiberglas Canada, Ltd., Oshawa, Ont.*

FIBERGLAS
*T. M. Reg. U. S. Pat. Off.

ARMY E NAVY

YARNS • TAPES • CORD • SLEEVING
CLOTH and OTHER FORMS



RATED VOLTAGE is always available to equipment protected with built-in CONSTANT VOLTAGE

"Operate at 115 volts" on the label of electrically operated precision equipment is not simply informative —*it's a warning!*

A *warning* that the device is too sensitive to tolerate the voltage fluctuations that may be met on America's power lines, and still perform with efficiency. A *warning* that sensitive tubes and other delicate mechanisms may be irreparably damaged by line surges and that costly replacements, with consequent loss of time and efficiency, lie ahead.

The design engineer who assumes that the precisely controlled voltages of the research laboratory will be duplicated in the field is heading his product toward trouble. Nominal line voltage ratings can no longer be used as single, stable reference points for design considerations. Commercial power lines are too heavily loaded and unpredictable.

"Operate at 115 volts" is no longer sufficient on a label. A guarantee that the "115 volts" will always be available, in spite of the unpredictable fluctuations of commercial power, is a prime requisite if the device is to perform with unfailing efficiency and precision.

The place to provide voltage control is within the equipment. With a Constant Voltage Transformer as a component part, the device is provided with a dependable source of voltage and unfailing protection against performance interference and construction damage.

SOLA Constant Voltage Transformers are available in sizes and capacities to meet design requirements of any electrically operated equipment or electronic device. Items so protected will deliver as efficiently in the field as under the most ideal laboratory conditions.

SOLA Constant Voltage Transformers have no moving parts to get out of order. There are no manual adjustments to be made. They perform instantly and automatically, maintaining output constant to within ± 1% of the rated voltage, regardless of line fluctuations as great as 30%.

SOLA Constant Voltage Transformers

To Manufacturers:
Built-in voltage control guarantees the voltage called for on your label. Consult our engineers on details of design specifications.
Ask for Bulletin JCV-74

Transformers for: Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Series Lighting • Fluorescent Lighting • X-Ray Equipment • Luminous Tube Signs Oil Burner Ignition • Radio • Power • Controls • Signal Systems • Door Bells and Chimes • etc. SOLA ELECTRIC CO., 2525 Clybourn Ave., Chicago 14, Ill.

CROUSE-HINDS

Explosion-Proof and Dust-Tight

Industrial Signal Condulets

(CONDULETS are manufactured only by CROUSE-HINDS)

Type ETH
Siren Signal

Type ETH
Howler Signal

Type ETR
Bell Signal

For hazardous locations in oil refineries and tankers; rubber plants; paint, varnish, plastics or chemical plants; grain elevators; mines; powder mills or arsenals; and other locations where highly flammable substances are manufactured, used or stored.

For use in noisy places or where signals must be heard from a distance.

Plain or coded signals, alone or in connection with a telephone

Alarms: for fire; changes in liquid levels, gas or air pressures.

Factory sealed; with pigtails in an explosion-proof junction Condulet for splicing to line wires.

Type ETH Siren and Howler Signals. 6 to 250-volt A. C. or D. C.

Type ETR Bell Signals. Continuous vibration; 110-volt Universal motor. Single stroke; 110-volt, 60-cycle A. C. Solenoid operation.

Listed in Condulet Catalog No. 2500, Section 85, Page 12C

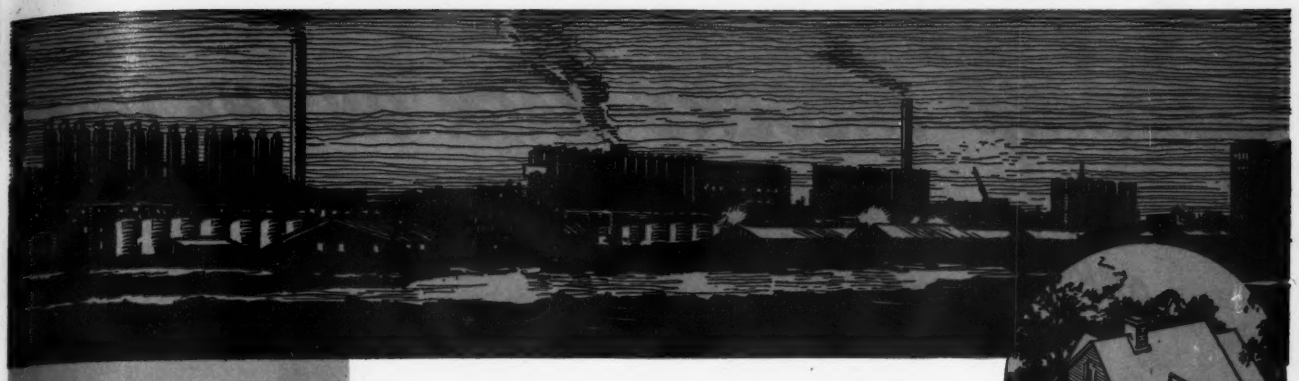
A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY

SYRACUSE 1, N. Y., U.S.A.

Offices: Birmingham — Boston — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington
Resident Product Engineers: Albany — Atlanta — Charlotte — New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS



ELECTRICAL EQUIPMENT

for the *Mammoth Plant* or the *Modest Building*

In post-war planning which involves expansion, modification or otherwise changing plant set-up or arrangement, the electrical system will doubtless require changes also. (FA) Engineers can be of great assistance in working out plans and specifications for economical and efficient service. Architects, engineers, and management are invited to submit their electrical problems — without obligation.

In the planning of new homes, stores, commercial or public buildings, or of remodeling existing structures, (FA) Products deserve consideration.

Load Centers and Service Equipment for homes . . . Panelboards for stores and commercial buildings . . . Switchboards — Feeder and Plugin Busduct distribution systems — Distribution Panelboards for power and light, for large and small plants . . . no matter what the requirements, (FA) can fill them . . . And (FA) Products are not only *approved* by Underwriters' Laboratories, Inc. They *exceed* the Laboratories' requirements.

Should standard (FA) Equipment not suit your purposes, we design and build equipment that will fit your specific needs.

More than fifty years of experience in keeping abreast or ahead of developments in the electrical field have given us the "know how". Use it to advantage — and without obligation.

Bulletins Are Available

on most of the (FA) Products listed at the left. Write for the ones in which you are interested — and for the name of the nearest (FA) Sales-Engineer . . . Frank Adam Electric Company, Box 357. St. Louis, Mo.

(FA) PRODUCTS

- **(FA) Busduct** — Feeder and Plugin Types and Plugin Devices
- **(FA) Duct** — for Wire and Cable
- **(FA) Panelboards and Cabinets** — Standard, Column and Dust-tight Types with Switch and Fuse, or Circuit Breakers
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Frank Adam
ELECTRIC COMPANY
ST. LOUIS

"Gramp" YAEGER'S BACK ON THE JOB!

...and

Miller is back with 100% steel reflectors—the same rigid steel construction you knew and used and liked in 1941 and 1942.

WPB has lifted the ban on steel for reflectors! And WPB says, "When oldtimers are provided with good lighting, tailored to their needs, it is frequently possible for them to keep on doing the precision work for which they are fitted."

MILLER 50 FOOT CANDLER or 100 FOOT CANDLER will provide plants with fine, man-made *daylight* . . . adequate, productive illumination evenly distributed over every working surface.

Better lighting will actually make workers see better, feel better, work better. It will help speed production, cut down spoilage, improve worker morale, reduce accidents, and make for smoother-running plants. And by using the Miller System, savings are effected in installation time and materials.

Just under 100 years of lighting experience . . . working with incandescent, fluorescent and mercury vapor . . . has enabled MILLER to offer through its engineers a lighting "expertness" which is at your command . . . to provide the best type of lighting system for your requirements. *Write or wire us today* and we'll get on the job at once.

BUY U. S. WAR BONDS

MILLER

50 FOOT CANDLER
100 FOOT CANDLER
Continuous Wireway Fluorescent Lighting Systems

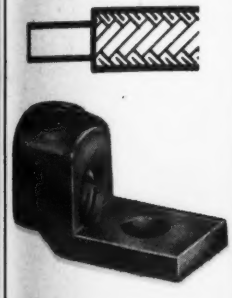
THE MILLER COMPANY
MERIDEN, CONN.
Pioneers in Good Lighting Since 1844

● MILLER offers a complete line of filament and fluorescent lighting equipment

A MILLER Message in line with WPB's helpful handbook, "Plant Efficiency."

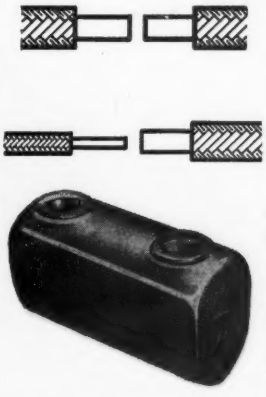
T&B Quick Guide For Maintenance and Repair Wiring Jobs

ooking them up the T&B Pressure (Solderless) Way



LOCK-TITE LUG

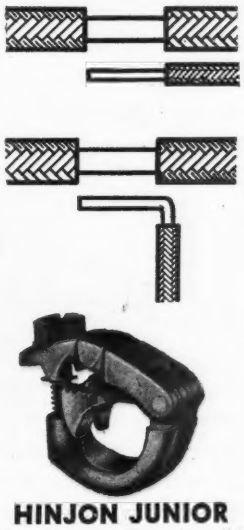
7 sizes take *all* cables #4 to 1,000,000 CM



LOCK-TITE 2-WAY

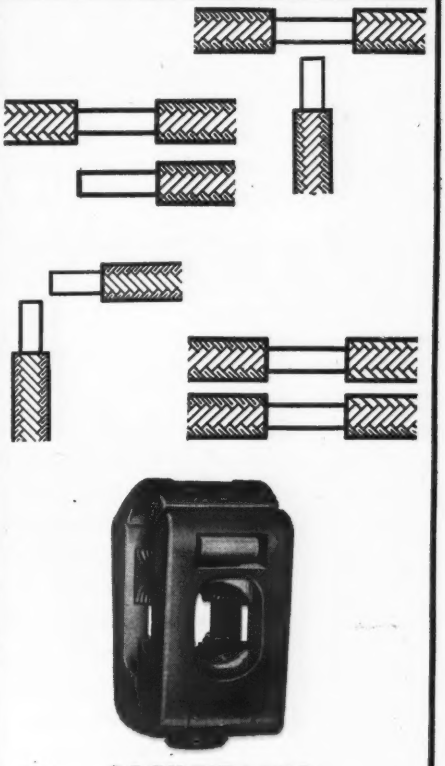
7 sizes make *all* splices #4 to 1,000,000 CM

Approved by Underwriters Laboratories



HINJON JUNIOR

12 sizes tap *all* mains #8 to 1,000,000 CM to all branches #14 to #1. Solid or stranded



LOCK-TITE TAP

6 sizes tap *all* mains 1/0 to 500,000 CM to all branches #2 to 500,000 CM

The Lock-Tite Way to button up wiring is simplicity itself.

A glance at the guide, pictures your individual wiring requirements and identifies the correct Lock-Tite Connector for the job.

Each Lock-Tite fitting is so versatile that it takes a wide range of overlapping cable sizes, and thereby saves stocking a miscellaneous assortment of seldom used pieces.

They are engineered to take solid, stranded, flexible, extra flexible, hemp-core, rod or tubing.

All Lock-Tite Connectors are one piece construction with no loose parts. A positive locking disc assures reliable performance under continuous severe vibration. Being solderless, they are a perfect cinch to install with key wrench or screw driver. Fully salvageable.

The Lock-Tite way of wiring helps the maintenance and repair man to put the juice back on, and keep it on.

All T&B products are sold, under the T&B Plan, exclusively through the T&B Distributor. He reduces the manufacturer's selling costs, thereby reducing the cost of all electrical material to the user. It is hard to see how War Production could be carried on without his highly organized services.

Write for complete Lock-Tite Maintenance and Repair Bulletin.

THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1899
ELIZABETH, N. J. NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal

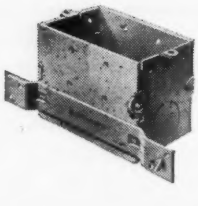
"RACO is one of the Best lines I ever had!"

THERE are lots of good reasons why so many contractors standardize on the Raco • All-Steel • Line. They know, from experience, that the line is complete—will meet every need, for repair and maintenance work or on large, new projects.

The acceptance of Raco • All-Steel • Products by architects and builders helps win approval for the contractors' work—eliminates kicks and dissatisfaction. Where Raco • All-Steel • Products are used, they're an indication of a "quality" job.

There are over 27 years of engineering experience back of the Raco • All-Steel • Line—the line that keeps pace with all wiring trends and developments. It is *sold exclusively through Electrical Wholesalers.* Insist on Raco • All-Steel • Products—look for the trade-mark on the package.

Remember . . . you can always rely on the Raco • All-Steel • Line.



At left—RMO switch box. Specially designed for use with many types of wall board. Right—DO-21-N3 outlet box. One of the newer boxes with protective 2-way clamp for non-metallic cables.

These are but two of the many dependable products in the Raco • All-Steel • Line.

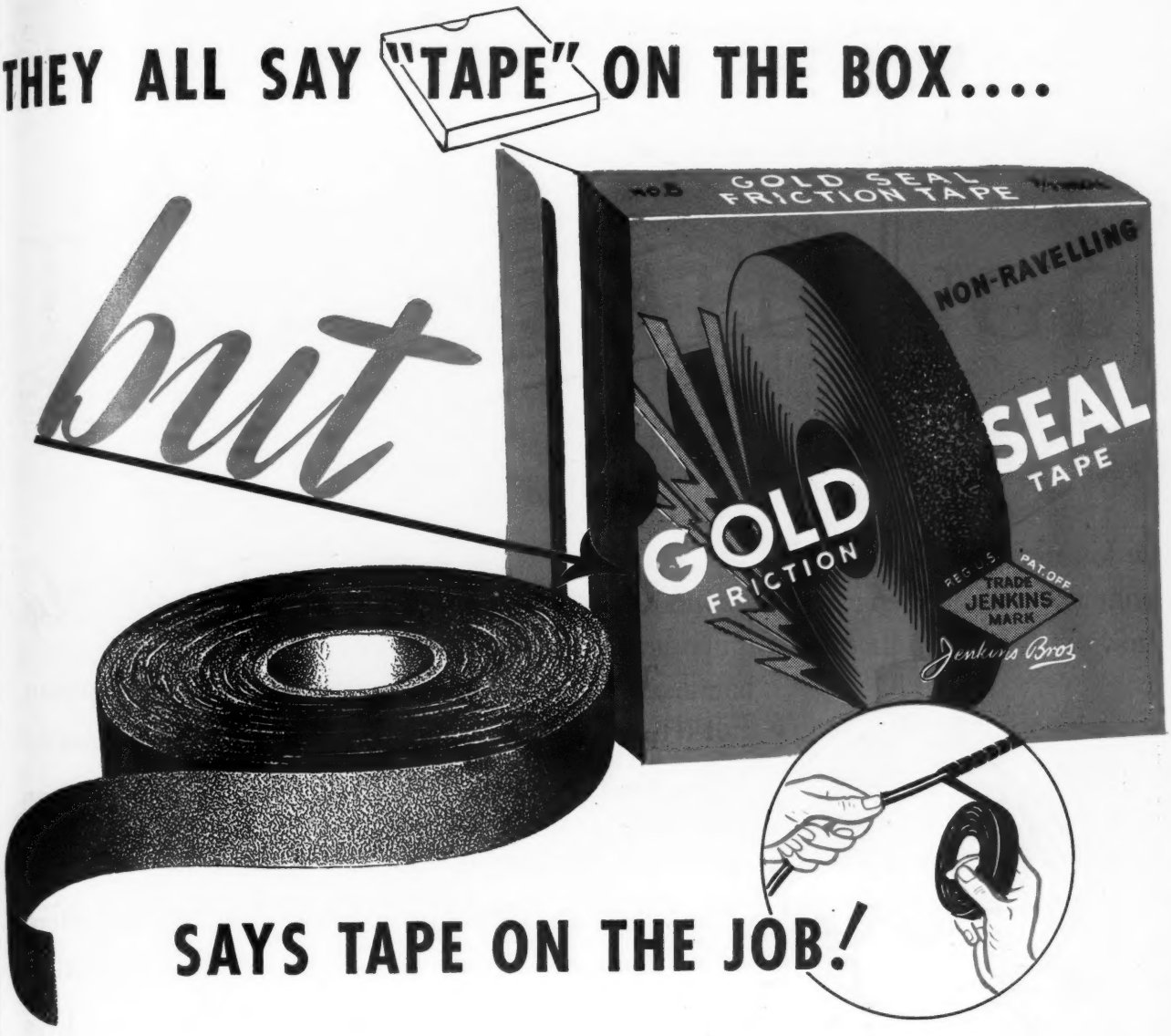
Distributed by

ALL-STEEL-EQUIP COMPANY, INC.

604 Griffith Avenue **Aurora, Illinois**

New England Representative: A. H. Tutin, 124 Pearl Street, Boston, Mass.

THEY ALL SAY "TAPE" ON THE BOX....



but SAYS TAPE ON THE JOB!

How can you tell the difference . . . how can you always be sure of the highest quality tape without experimenting around?

The answer is easy: Ask for *Gold Seal* – by name – every time you order tape. You'll get greater tackiness that gives a firmer, longer-lasting bond. Higher tensile and insulating strength. A non-raveling tape that doesn't "peel" or dry out. You'll find Gold Seal uniform all the way from the first strip off the roll to the last!

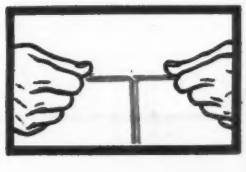
Try Jenkins *Gold Seal* tape on your next tough job. Convince yourself that there's as much difference between tape as between other materials and tools of your business! Jenkins Bros., (Rubber Division), 80 White Street, New York 13, N. Y.

Other Jenkins Bros. tape products include Diamond Seal Friction Tape, and Diamond Seal Rubber Tape, which meet ASTM and Federal specifications.

Convince yourself

MAKE THIS EASY TEST!

1 Tear two 6 inch strips from a roll of *Gold Seal* tape and stick faces together. Do not apply pressure.



2 Pull the strips apart slowly, forming a "T". Feel what a stiff pull this takes. Note long adhesion "teeth" at point of separation.

JENKINS *Gold Seal Tapes*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

One Source of Supply

The advantages of a single source of supply are practical and economic. ART METAL "delivers the goods" with service, convenience and completeness.

Commercial fixtures — fluorescent and incandescent. Vapor proof units — utility reflectors. Special location units. Exit lighting. Industrial reflectors. Safety Hangers and Pendants. Even the few we illustrate take care of an unusually wide range of needs.

THE ART METAL COMPANY

Manufacturers of Engineered Lighting and Ultraviolet Equipment

1814 EAST 40TH STREET • CLEVELAND 3 • OHIO

INVASION *and the* FINAL CHALLENGE

The idea that our national security some day would depend upon the successful invasion of continental Europe by our armed forces was inconceivable to the average American but a few short years ago. Yet, today our whole strength is assembled to that very action and for assuring a sound and permanent peace.

America became great without aggression . . . without tyranny. Our greatness has been achieved without destroying others . . . ours is a history of unprecedented industrial progress, of development of our own resources and reliance on our own efforts.

Aggression is foreign to American philosophy. Yet, today we find ourselves faced with the choice of destroying or being destroyed. Today we are confronted by the hard fact that the kind of peace which we all so fervently desire can be achieved only by crushing autocracy and by removing the causes of aggression.

We are now engaged in the accomplishment of the first objective. Since Pearl Harbor a complacent, peace-loving America—the largest of the "soft" and "decadent" democracies—has grown strong and tough. Out of the inherent virility of a free people we have moulded the mightiest force for invasion and attack that the world has ever seen.

We have reached our peak rates of war production. We are producing as much war equipment as all the rest of the world combined.

History will record our industrial mobilization as a phenomenal achievement.

The battle of production has been won!

The full might of our armed forces and those of our allies unleashed against the Axis war machine will bring eventual victory. Two and a half years of intensive preparation, backed by 168 years of growth as a free nation, has given us superiority over twenty years of painstaking preparation by the totalitarian and militaristic countries with their enslaved peoples.

Every American has contributed toward this powerful offensive. Our manufacturers and business leaders have exerted their fullest efforts. Our industries have mobilized their tremendous resources—tapped to the fullest degree their inventive and productive genius. The men and women in the factories, on the farms, and in the mills and mines have played a magnificent

part in the tremendous production program. Citizens all are making their contribution to the armed victory that lies ahead

We have demonstrated that a free people under a free enterprise economy can unite in a common purpose.

* * *

When the war is won, we shall be faced by our second objective . . . removing the causes of aggression. This is a social challenge. A challenge to those who would sacrifice our democratic way of life for personal gains or foreign ideologies.

The best insurance for the continuance of our democracy is a successful democracy. That means a dynamic and not a static democracy. All of us who want to preserve the ideals that have made America . . . and that includes all but a handful of extremists . . . must determine to find the policies and programs which will permit us to make the most of the abundance nature has provided for us.

To achieve this end we must recognize the fact that we are but a wheel in the machinery of world economy. A wheel that must drive or be driven. A wheel that must mesh smoothly with the many other wheels or be stripped of its cogs.

We are the only nation on earth free enough and strong enough to shape the mould of its own destiny. We can be hampered by nothing but our own confusion.

* * *

The mind and the heart of all America today brood over the shores of Britain and watch over the narrow waters that wash the beaches of the Continent. And the prayers of all America go with each of those who embark upon that epic passage.

Those of us at home who are producing the fighting tools and who are so earnestly concerned with the problems that will face a postwar America, should see now, even if we may never have seen it before, that all our plans will be worth just exactly what the men and women who make that passage are prepared, competent, and inspired by their leadership to make them worth.

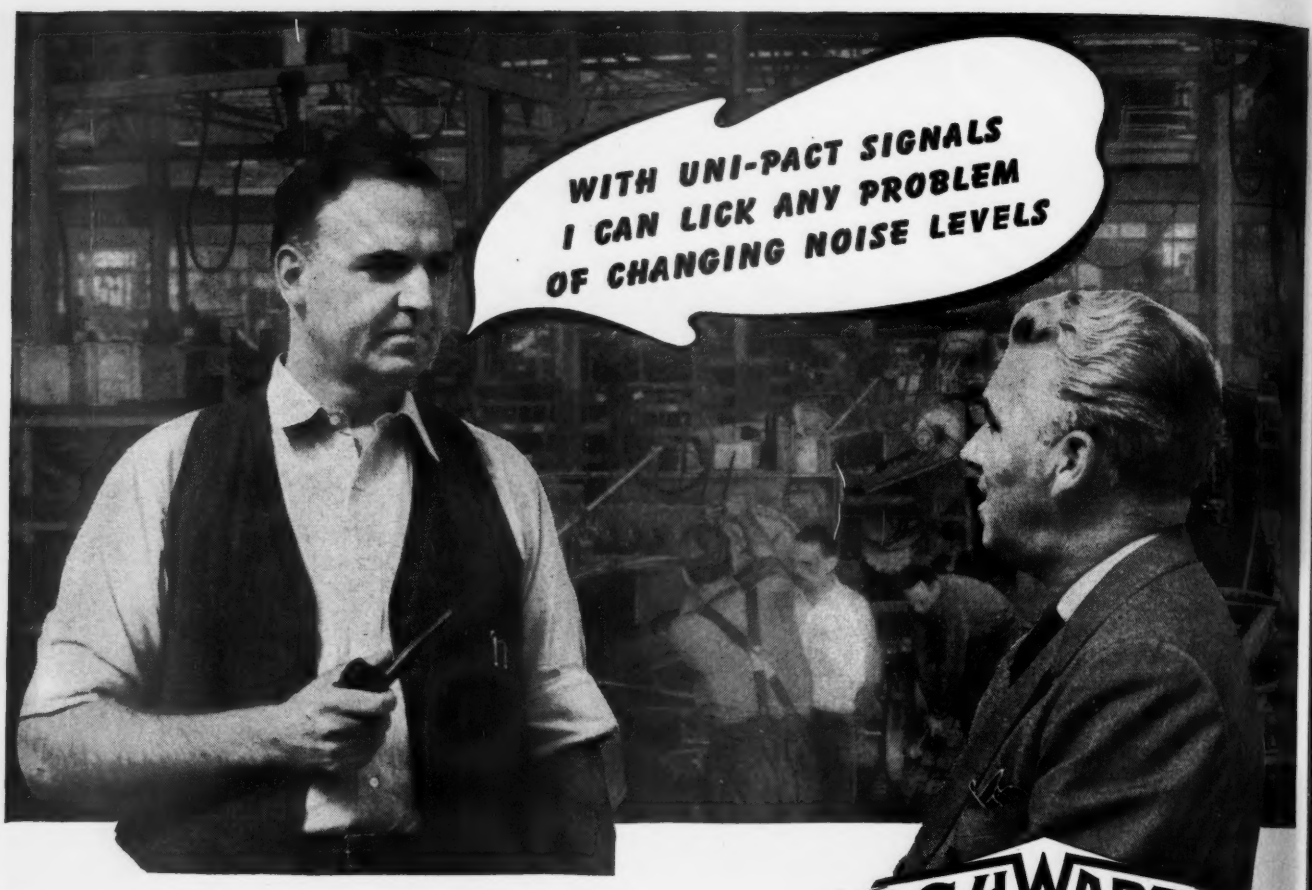
For those men and women are America!

They have gone out from rich homes and poor homes alike, from farms and factories, from schools and churches, from mines and ranches, from offices and studios, to take their places in the battle line. They are a cross-section of the America that is to be.

Whoever may draw the plans for that America, it is those men and women who will make the plans good. Invasion is their first step toward that end. May their work be speedily done, and may our plans be worthy of that work.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.



SCHWARZE
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AUDIBLE ELECTRIC SIGNALS

Maximum Flexibility at no added cost

with the famous

SCHWARZE-FARADAY UNI-PACT DESIGN

You'll find appreciation among your trade for the greatly added flexibility made possible by the famous Schwarze-Faraday UNI-PACT feature. It simplifies plant signal problems, while saving time, maintenance and installation costs. One outlet, with a single adapter-plate allows the user to meet changing plant conditions by merely plugging in Bell, Horn or Kodaire, as required.

The Schwarze-Faraday Complete Line Contains Signals for Every Plant Need

Included are Horns, Bells, Buzzers, Air-Trumpets, Kodaires and Chimes, all durable, dependable, and economical. Our factory-trained engineers will gladly assist you in designing installations in accordance with any plant's requirements.

They all fit the same adapter plate

UNI-PACT Saves Time, Maintenance and Installation Costs

The Dead Front Adapter-Plate is a part of each UNI-PACT signal assembly. It is identical for all sizes and fits each one without change of electrical connections.

Send for FREE Catalog—Completely indexed, illustrated, and convenient to use, our new Buyers Book of Electrical Signals will prove an invaluable reference guide.

SCHWARZE ELECTRIC COMPANY
ADRIAN, MICHIGAN

CENTRAL RIGID STEEL CONDUIT

Installed in 1931 and still doing a good job

North Corridor of Filter Building
City of Detroit, Department of Water Supply
Spring Wells Station

Control House during construction, August, 1931

"There's Tested Strength in Every Length"

SPANG-CHALFANT

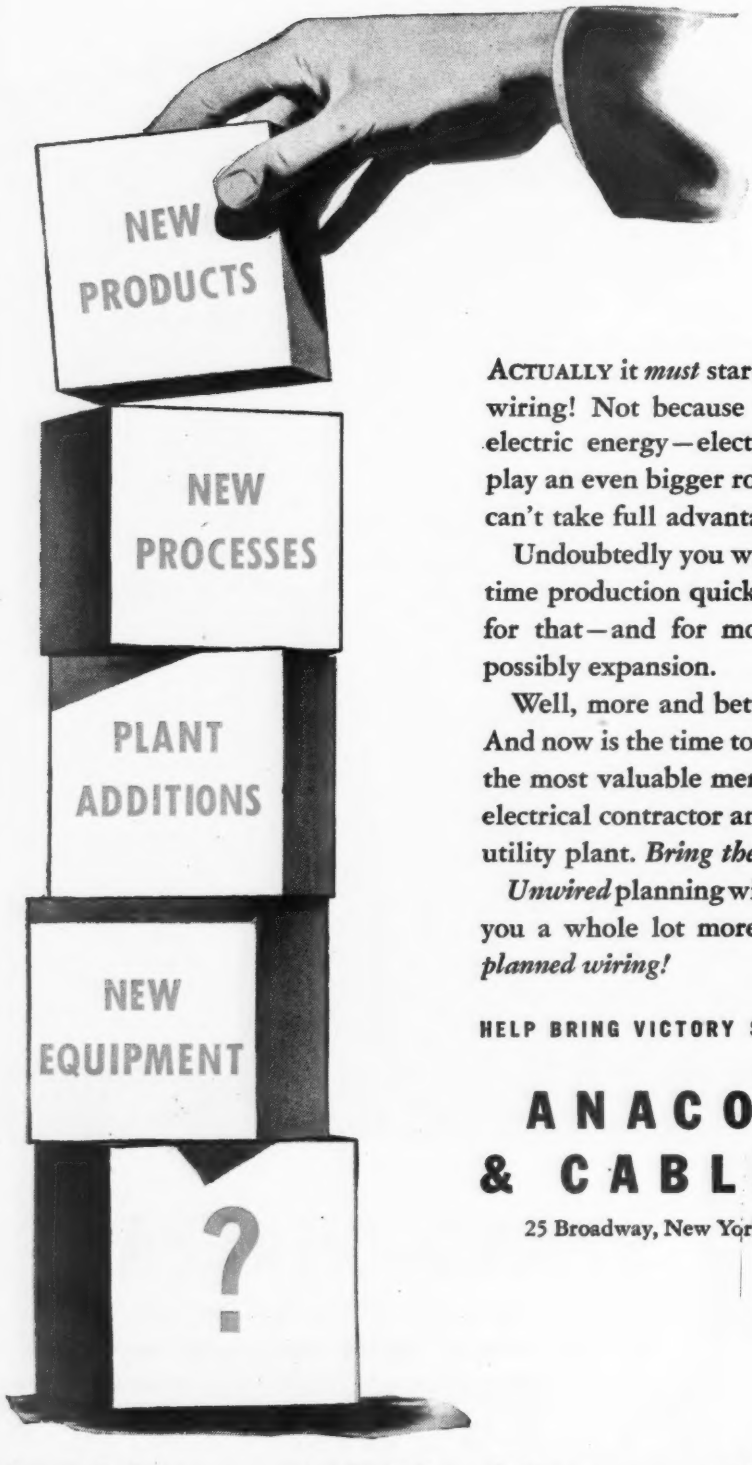
Division of The National Supply Company

Executive Offices: Grant Building, Pittsburgh, Pa.

District Offices and Sales Representatives in Principal Cities

(Here's another ad in the series that brings a vital message to your customers.)

Know where that postwar plan of yours ought to START?



ACTUALLY it *must* start with electrical wiring . . . *adequate* wiring! Not because we think so—but simply because electric energy—electric-motorized power—is going to play an even bigger role in postwar production. And you can't take full advantage of it without the right wiring.

Undoubtedly you want to swing your plant into peacetime production quickly after the war. You've got plans for that—and for modernization . . . improvements . . . possibly expansion.

Well, more and better wiring will have to come first. And now is the time to plan for it—in advance. Just about the most valuable men you could talk to today are your electrical contractor and a power engineer from the local utility plant. *Bring them into the advance planning stage.*

Unwired planning will cost you a whole lot more than *planned wiring!* 44226

ADEQUATE WIRING KEY TO POSTWAR BUSINESS SERVES AND SAVES

HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS.

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

ANACONDA

Electrical Wires and Cables of Copper are the Life Lines of our Nation

FIGURING LABOR CHANGES

One of the most hopeful indications that the electrical contractor will be ready for the rapid changes and the complex business problems of the transition period of war to peace is the current revival of interest in accurate estimating practices. The NECA cost data committee is stepping up its activity. The Chicago Electrical Estimator Association which has through the years contributed so much to the scientific prediction of labor-hour figures for all kinds of electrical construction is busy with a number of new labor analyses. Studies of overhead costs as they are related to different labor-material ratios are in progress.

Studies—and there are only a few examples of the current activity—in accurate estimating and accounting are, of course, immediately useful for the solution of problems of contract termination, change orders and current job management. However, they will also lay the groundwork for an intelligent and hardboiled appraisal and approach to postwar wiring markets.

During the busy war years there was less need for critically accurate estimating. There have been, consequently, a slackening of interest in labor-hour studies and analyses. With a return to our normal economy and ways of doing business coming closer every day, however, estimators are compiling and developing much of the experience data which has accumulated in the last few years. But beyond the need for continued study toward accurate labor hour units there are three broad problems bearing on the future methods and practices of our industry, that, in my opinion should have study now and wide discussion among estimators over the country well ahead of the reconversion period.

1) A comprehensive study of the effects on labor hour units when the average skill of mechanics rises to normal.

2) A study of job management methods and the effect on labor-hour units when job crews include skilled but partially disabled war veterans.

3) A study of the probable effects of annual wage plans on labor-hour units and average labor-hour costs on the job.

Whatever top-side policies that individual firms on labor-management groups may consider regarding these problems—and they are all under discussion today—it is the engineer and the estimator who must finally adapt them to the realities of job management, accurate cost predictions and sound accounting. And studies now by cost data committees and estimator groups can place accurate facts and figures in the hands of those who must eventually decide on the settled policies.

Wm. F. Stuart

Electrical Contracting

MAY, 1944

Your GRAYBAR Man offers *Application Aid*

ALTHOUGH much of the major construction along the road toward victory is completed, many jobs still remain to be done. Conversion to new types of war production or to civilian production generally means plant rewiring. Power distribution may require modernization, as loads increase. Maintenance contracts have become an important responsibility of many electrical contractors. Municipal construction, essential to public welfare, continues to be needed. Housing projects are still incomplete.

The nation's electrical contractors may well take pride in the major role they have played so far in the building of Victory Road. In all of their activities, they are supported by Graybar Specialists . . . men who can aid you in *selecting and prescribing* the right equipment for any kind of job.

You can depend on your Graybar Man to keep you informed on the latest equipment, tools and processes. This, like other Graybar services, is yours for the asking, and only as far away as your telephone. Just call your local Graybar office. 3536

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IN OVER 80 PRINCIPAL CITIES

EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK 17, N. Y.

GraybaR QUALITY *REG U.S. PAT. OFF. 75 YEARS OF *Electrical Distribution*

PLAN for POSTWAR RELATIONS

Minnesota electrical contractors have written and endorsed a plan for postwar industry relations. It frankly discusses the contractor's problems. It offers some forthright methods for their solution.

FOR many months past special Post-war Planning Committees and many individual members of the Minnesota Electrical Council have given thought to the future business welfare of electrical contractors and to the postwar business development of the electrical industry as a whole. The contents of this report covers only those problems, conditions and recommendations on which there is general agreement among the committees and other members who have expressed their views.

It is not intended that this report shall be considered complete or conclusive. It is tentative in many respects, subject to changes as additional thought and evidence may bear on any phase of the report. Additions may be made as further need or opinions may indicate. It would be impossible at this stage to catalog all of the problems or recommendations which would have a material bearing on the future of an industry as large and important as the electrical industry. It is impossible to divorce the problems and plans of our branches of the industry from those of the industry as a whole. Therefore the Council committees have adopted a broad approach to problems, plans and recommendations.

Relations with Electrical Wholesalers

We acknowledge with sincere appreciation the cooperation of the electrical wholesalers over a period of years in furthering the welfare of their contractor-dealer customers. Much consideration has been shown toward the efforts of the Minnesota Electrical Council to improve the position of the contractors and dealers. This we believe has been of mutual benefit as evidenced by the fact that up to the time of our Country's entry into World War II, the Council members had generally arrived at the soundest position in their business careers.

There remain however some serious problems to be corrected, resulting from the tendency of some wholesalers to solicit business and sales direct to users, in competition with electrical contractor-dealers, particularly in the industrial and commercial field relating to electrical supplies, apparatus and lighting equipment. It is evident that any wholesalers who enter into direct competition with contractor-dealers can hardly expect to retain the respect and good will of the latter. We recommend that any wholesaler who finds that improved trade relations are in order, make such changes as may seem necessary to maintain the system of distribution through the normal trade channels which have been a wholesome part of American free enterprise.

More recognition should be given to the proper part which every factor plays in the American business system. Each one should be assured of just compensation for his contribution of skill and service to the ultimate consumer. We earnestly recommend a careful study of distribution practices to the end that unfair or discriminatory tactics be eliminated.

It should be recognized in particular that the contractor cannot exist solely as broker for labor alone on electrical installations or construction projects. When it is impossible to fix definite overhead percentage charges against known material quantities and costs, this business becomes largely a game of chance with the cards stacked against the contractor. The only other alternative would be to add the entire overhead burden on labor charges; such action would only serve to jeopardize the contractors future as a business operator.

Relations with Electrical Manufacturers

We recommend the alert efforts of the manufacturers and their representatives who are cooperating with other electrical industry groups in this area

BACKGROUND

The Minnesota Electrical Council postwar program was prepared by a committee of the Council and endorsed by its members at a meeting in St. Paul on March 27. The Council, started in 1933, is a central coordinating organization for electrical contractors and dealers in the North Central area. It has always followed a strong policy of industry cooperation and was a major factor in the organization of the North Central Electrical Industries, an all-industry clearing house coordinating the promotional activities of all branches of the industry in the area.

Much of the original plan has been deleted in this article to allow space for a full presentation in the committees own words of the major work dealing with inter-industry relations. The portions omitted deal with builders and architects, appliance sales, promotion programs of the Council and recommendations relating to the State laws and ordinances.

To say that the Council, its officers and Secretary-Manager Bill Ritt enjoy the confidence and good will of the public and the trade is to risk understatement. And the frankness of this report is characteristic. It is the work of sincere and able men. Even though it is concerned with the specific problems of one area it deserves close study by everyone concerned with the future of our industry.

W. T. STUART

to promote more sales and sound business development. Their friendly and helpful assistance in many ways has contributed much to the progress and prestige of their contractor-dealer customers.

We are however constantly aware that the services of electrical contractors and dealers are not always given due consideration by some manufacturers. This is evidenced by failures to provide for adequate differentials to compensate the contractor-dealer for his services in relation to known overhead and sales expense. Also, while it is common policy to distribute electrical products through wholesalers with presumably satisfactory margins to cover overhead, sales expense and services rendered, it is not so common that the plan of distribution calls for equal consideration of the contractor-dealers place in the process of distribution and customer service.

It is our sincere belief that the progress of our industry would be accelerated and that consumers would be better served if the contractor-dealers position was given more consideration in such cases where there is room for improvement in present practices.

There has grown up within the electrical industry a questionable theory that electrical contractors can do business on a margin of 10 to 15 percent, although the wholesalers margin is generally as much or more on some of the same products. In some cases the basic discount is inadequate. In other cases, published discounts or net prices to industrials and other consumers leave an insignificant margin to contractors. Another trend is evident in the pricing of some industrial lighting equipment where the contractors differential is entirely inadequate.

We recognize the justification for smaller margins on quantity purchases, but quantity purchases should be defined as substantial amounts purchased or sold for one delivery. Handling small billings on a retail basis, on margins less than those received by wholesalers is economically unjustifiable. When wholesaler sells to industrials he has both his wholesale profit, plus the differential on which the contractor is expected to operate. If electrical contractors are to contend with such an arrangement, it is obvious that the contractor must buy on a more favorable basis. The margin available to electrical contractors must inevitably cover the recognized costs of doing business, plus a reasonable profit incentive for securing and handling the order.

Lighting Equipment

The present structure on all classes of lighting equipment seems to warrant serious consideration and numerous changes which will be more favorable to the purchaser as well as to the trade, if our industry as now constituted wishes to retain a leading position in a highly competitive postwar market. Here are a few examples of what we mean:

(a) Floodlighting equipment is available to educational institutions and industrials at the same prices which contractors are expected to pay, but there is a protection or differential on such equipment for the wholesaler. Generally, contractors are called upon to install this class of equipment, and their opportunity to participate in the sale is limited to those installations on which lump sum bids are called for. Buyers who are aware of this condition frequently by-pass the contractor by purchasing the equipment and installing them on a day labor basis; this has been encouraged by others in some cases.

(b) Industrial lighting equipment is generally subject to the conditions set forth in the section herein dealing with the subject of industrial accounts. Here again the contractor's chances for profitable participation are rather remote unless he is placed in a better competitive position by reason of more favorable differentials.

(c) Commercial lighting hangs on a precarious structure which is out of balance and threatens to collapse.

It must be obvious that the industry cannot justify the present unbalanced price structure in fluorescent lighting equipment. It will tend, if continued, to force the contractor to buy and sell in competition with the wholesaler, or we must resign ourselves to seeing the bulk of this business turned over to the so-called peddlers or direct-factory-to-user salesman. If we are to maintain normal channels of distribution, the contractor must have just as much assurance as the wholesaler has in receiving adequate margins at least sufficient to cover the normal cost of doing business.

Some thought might be given to exclusive distribution of some fixture lines through franchised dealers with full protection to the dealers. This has been worked out in some lines of fixtures, particularly residential, sold by some factories only through authorized dealers.

RESIDENTIAL FIXTURES—The contractor-dealer who regularly stocks residential fixtures should be entitled to a better discount than that which is available to contractor-dealers, who expect the wholesaler to maintain fixture display rooms for customers selection and provide salesmen to wait on such customers and even render a bill and make the collection. The contractor-dealer who does not use the

holesalers services in making fixture les cannot be expected to subsidize is form of competition by paying as uch for his stock merchandise as the mpetitor who does not carry a stock d throws his selling expense on the oulders of the wholesaler. No one ould expect the wholesaler to perform tail services on a no-charge basis, d the cost of such services should t be charged against those who do t use them.

The trend toward the sale of numer- s small inexpensive fixtures instead fewer larger pieces has made selling ore expensive in relation to volume d such small pieces cannot be stocked d sold at a margin which amounts to little as 50 cents apiece. It takes almost as much time and expense to sell and handle a $1.50 item as it does one selling at $10 or more. Unless we recognize and correct some of the problems, our industry will lose more and more of this business to other outlets who handle fixtures as packaged or "over the counter" merchandise.

DISTRIBUTION OF CATALOGS AND PRICE LISTS—Promiscuous distribution of wholesalers catalogs, cost and discount sheets, has been a wasteful and demoralizing practice, and should be curtailed in the interests of conservation and good business.

UNFAIR SUBSIDIES—Unless a supplier extends the same services to all customers or makes due allowance for same to those who do not require them, such subsidies or discriminatory practices as the following should be discontinued:

(a) Free estimating or "take off" services (except on lump sum items such as fixtures or panelboards).

(b) Unusual financing, or covering of certified checks or bonds.

(c) Discriminatory prices, discounts, rebates or allowances.

(d) Retail sales services, billing or collections which are customarily performed by contractors.

(e) Bidding directly or individually in competition with electrical contractors, for materials, fixtures or equipment on an installed basis.

Utility and Contractor Relations

Much progress has been made during recent years in establishing and maintaining a better working relationship between electrical contractors and the utilities to the end that the important functions of the contractor as an essential part of the industry are better understood and appreciated. This progress should be zealously maintained by all concerned in order to attain the highest standards of satisfactory service to the public.

There have been occasions in the past where some utility people have brought into question or even tried to establish, prices charged by electrical contractors, just as there have been cases where contractors have criticized utility rates. As a general proposition such actions on the part of both branches of the industry seem to be out of order, and every effort should be made by both parties to arrive at a fair understanding of each others problems through the medium of industry associations.

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We recognize the great responsibility of our industry along with others

[Continued on page 170]

COMPETENT ELECTRICAL CONTRACTOR DEFINED

1. **Is a licensed Master Electrician or has one permanently employed.**
2. **Has a permanent business location or headquarters.**
3. **Has a practical knowledge of good estimating and accounting practice, or employs qualified personnel for such purposes.**
4. **Is equipped with all necessary tools, instruments and facilities for efficiently carrying out any type of work which he undertakes to do.**
5. **Has dependable sources of information and makes good use of such as occasion requires.**
6. **Is properly financed by himself or agencies other than suppliers.**
7. **Makes every reasonable effort to know and comply with all laws and regulations affecting electrical installations and business conduct.**
8. **If he is an employer, to deal fairly with his employees who must in the end contribute to the success or failure of any free enterprise business.**
9. **Is preferably a member of his trade association, contributing of his money and effort for the advancement of the whole industry.**
10. **Carries all those forms of insurance which are essential to the safeguarding of his customers' interest and for the protection of his own equity as well as that of his suppliers.**

BACKGROUND

The Minnesota Electrical Council postwar program was prepared by a committee of the Council and endorsed by its members at a meeting in St. Paul on March 27. The Council, started in 1933, is a central coordinating organization for electrical contractors and dealers in the North Central area. It has always followed a strong policy of industry cooperation and was a major factor in the organization of the North Central Electrical Industries, an all-industry clearing house coordinating the promotional activities of all branches of the industry in the area.

Much of the original plan has been deleted in this article to allow space for a full presentation in the committees own words of the major work dealing with inter-industry relations. The portions omitted deal with builders and architects, appliance sales, promotion programs of the Council and recommendations relating to the State laws and ordinances.

To say that the Council, its officers and Secretary-Manager Bill Ritt enjoy the confidence and good will of the public and the trade is to risk understatement. And the frankness of this report is characteristic. It is the work of sincere and able men. Even though it is concerned with the specific problems of one area it deserves close study by everyone concerned with the future of our industry.

W. T. STUART

to promote more sales and sound business development. Their friendly and helpful assistance in many ways has contributed much to the progress and prestige of their contractor-dealer customers.

We are however constantly aware that the services of electrical contractors and dealers are not always given due consideration by some manufacturers. This is evidenced by failures to provide for adequate differentials to compensate the contractor-dealer for his services in relation to known overhead and sales expense. Also, while it is common policy to distribute electrical products through wholesalers with presumably satisfactory margins to cover overhead, sales expense and services rendered, it is not so common that the plan of distribution calls for equal consideration of the contractor-dealers place in the process of distribution and customer service.

It is our sincere belief that the progress of our industry would be accelerated and that consumers would be better served if the contractor-dealers position was given more consideration in such cases where there is room for improvement in present practices.

There has grown up within the electrical industry a questionable theory that electrical contractors can do business on a margin of 10 to 15 percent, although the wholesalers margin is generally as much or more on some of the same products. In some cases the basic discount is inadequate. In other cases, published discounts or net prices to industrials and other consumers leave an insignificant margin to contractors. Another trend is evident in the pricing of some industrial lighting equipment where the contractors differential is entirely inadequate.

We recognize the justification for smaller margins on quantity purchases, but quantity purchases should be defined as substantial amounts purchased or sold for one delivery. Handling small billings on a retail basis, on margins less than those received by wholesalers is economically unjustifiable. When wholesaler sells to industrials he has both his wholesale profit, plus the differential on which the contractor is expected to operate. If electrical contractors are to contend with such an arrangement, it is obvious that the contractor must buy on a more favorable basis. The margin available to electrical contractors must inevitably cover the recognized costs of doing business, plus a reasonable profit incentive for securing and handling the order.

Lighting Equipment

The present structure on all classes of lighting equipment seems to warrant serious consideration and numerous changes which will be more favorable to the purchaser as well as to the trade, if our industry as now constituted wishes to retain a leading position in a highly competitive postwar market. Here are a few examples of what we mean:

(a) Floodlighting equipment is available to educational institutions and industrials at the same prices which contractors are expected to pay, but there is a protection or differential on such equipment for the wholesaler. Generally, contractors are called upon to install this class of equipment, and their opportunity to participate in the sale is limited to those installations on which lump sum bids are called for. Buyers who are aware of this condition frequently by-pass the contractor by purchasing the equipment and installing them on a day labor basis; this has been encouraged by others in some cases.

(b) Industrial lighting equipment is generally subject to the conditions set forth in the section herein dealing with the subject of industrial accounts. Here again the contractor's chances for profitable participation are rather remote unless he is placed in a better competitive position by reason of more favorable differentials.

(c) Commercial lighting hangs on a precarious structure which is out of balance and threatens to collapse.

It must be obvious that the industry cannot justify the present unbalanced price structure in fluorescent lighting equipment. It will tend, if continued, to force the contractor to buy and sell in competition with the wholesaler, or we must resign ourselves to seeing the bulk of this business turned over to the so-called peddlers or direct-factory-to-user salesman. If we are to maintain normal channels of distribution, the contractor must have just as much assurance as the wholesaler has in receiving adequate margins at least sufficient to cover the normal cost of doing business.

Some thought might be given to exclusive distribution of some fixture lines through franchised dealers with full protection to the dealers. This has been worked out in some lines of fixtures, particularly residential, sold by some factories only through authorized dealers.

RESIDENTIAL FIXTURES—The contractor-dealer who regularly stocks residential fixtures should be entitled to a better discount than that which is available to contractor-dealers, who expect the wholesaler to maintain fixture display rooms for customers selection and provide salesmen to wait on such customers and even render a bill and make the collection. The contractor-dealer who does not use the

wholesalers services in making fixture sales cannot be expected to subsidize this form of competition by paying as much for his stock merchandise as the competitor who does not carry a stock and throws his selling expense on the shoulders of the wholesaler. No one should expect the wholesaler to perform retail services on a no-charge basis, and the cost of such services should not be charged against those who do not use them.

The trend toward the sale of numerous small inexpensive fixtures instead of fewer larger pieces has made selling more expensive in relation to volume and such small pieces cannot be stocked and sold at a margin which amounts to as little as 50 cents apiece. It takes almost as much time and expense to sell and handle a $1.50 item as it does one selling at $10 or more. Unless we recognize and correct some of the problems, our industry will lose more and more of this business to other outlets who handle fixtures as packaged or "over the counter" merchandise.

DISTRIBUTION OF CATALOGS AND PRICE LISTS—Promiscuous distribution of wholesalers catalogs, cost and discount sheets, has been a wasteful and demoralizing practice, and should be curtailed in the interests of conservation and good business.

UNFAIR SUBSIDIES—Unless a supplier extends the same services to all customers or makes due allowance for same to those who do not require them, such subsidies or discriminatory practices as the following should be discontinued:

(a) Free estimating or "take off" services (except on lump sum items such as fixtures or panelboards).

(b) Unusual financing, or covering of certified checks or bonds.

(c) Discriminatory prices, discounts, rebates or allowances.

(d) Retail sales services, billing or collections which are customarily performed by contractors.

(e) Bidding directly or individually in competition with electrical contractors, for materials, fixtures or equipment on an installed basis.

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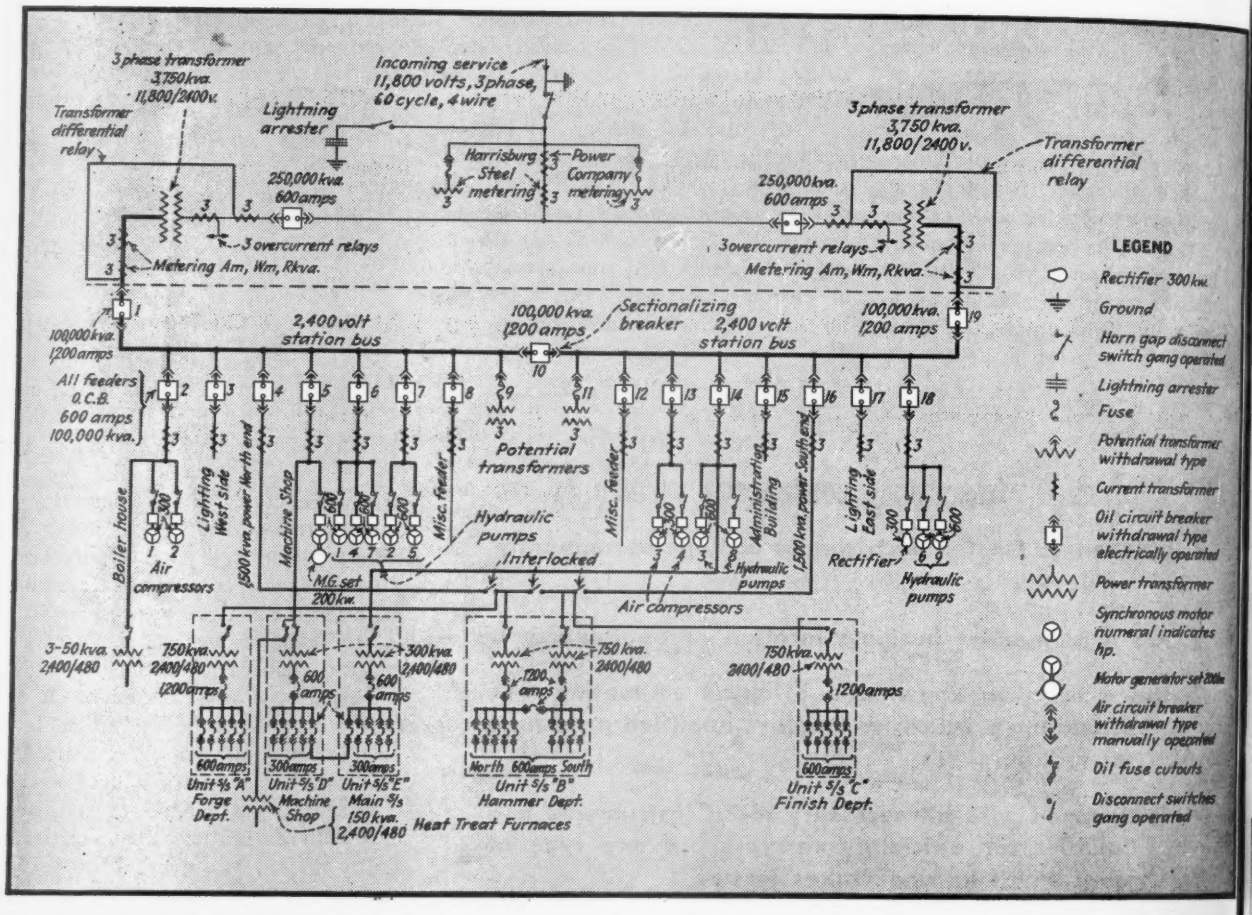
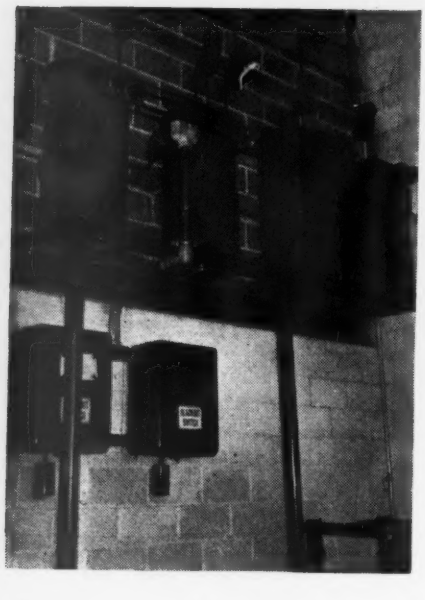
[Continued on page 170]

HIGH VOLTAGE



***ONE LINE DIAGRAM** of the electrical system. Portion above the dotted dividing line is located outside. Note the interlocked disconnects at unit substation B which will permit the total load to feed from either side of the station bus. Note also how loads are divided on either side of the sectionalizing breaker so that in case of isolatable trouble, all the air pressure, or water pressure, or lights or direct current is not lost.*



***TWO OPEN-DELTA BANKS** of lighting transformers are provided for blackout conditions. The one supplies yard lighting and is to be turned out in case of blackout. The other supplies indoor monitor lights and is turned on in emergencies.*

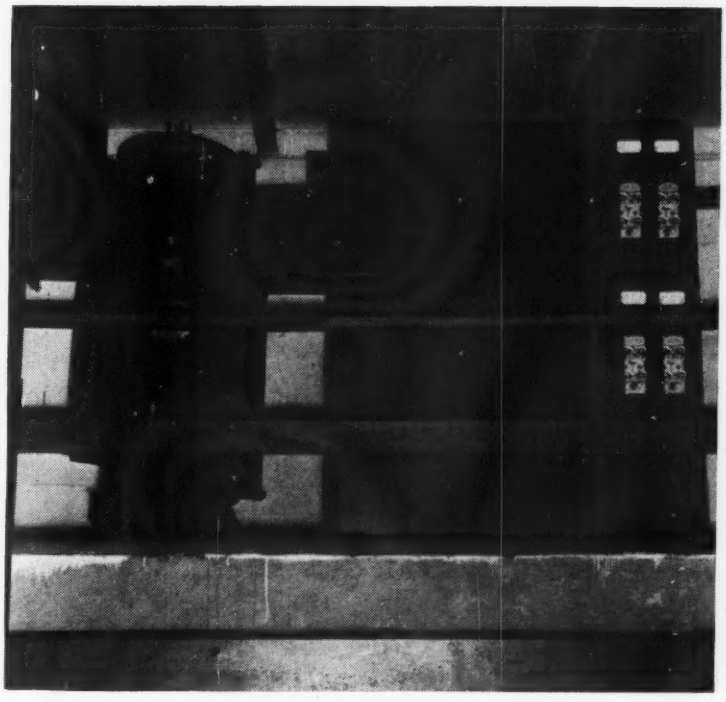
FIBER duct is used exclusively to carry 2,400 volt light and power distribution circuits in Harrisburg Steel Company's new DPC plant in Harrisburg, Pa. Some of the duct is carried underground in concrete envelope but the majority is carried by overhead suspension hangers from the building structural steel. Unit substations are located at various power load centers transforming the distribution voltage of 2,400 volts to a utilization voltage of 480 volts. The 300 hp. and 600 hp. synchronous motors driving air compressors and hydraulic pumps are fed 2,400 volts direct from the metal-clad switchgear. Lighting distribution is also 2,400 volts and is transformed to 120/240 volts, three-wire at the various lighting load centers by 15 kva, and 25 kva. single phase dry-type units hung two on a column and connected in open delta on primary. Secondary lighting circuits are run open on porcelain knobs to incandescent and mercury units alike.

Power is brought into the outdoor primary substation by hi-line at 11,800 volts. The outdoor metal enclosed switchgear sets in the middle of the concrete mat and feeds through metal enclosed high-voltage copper bus to two 3,750 kva. three-phase transform-

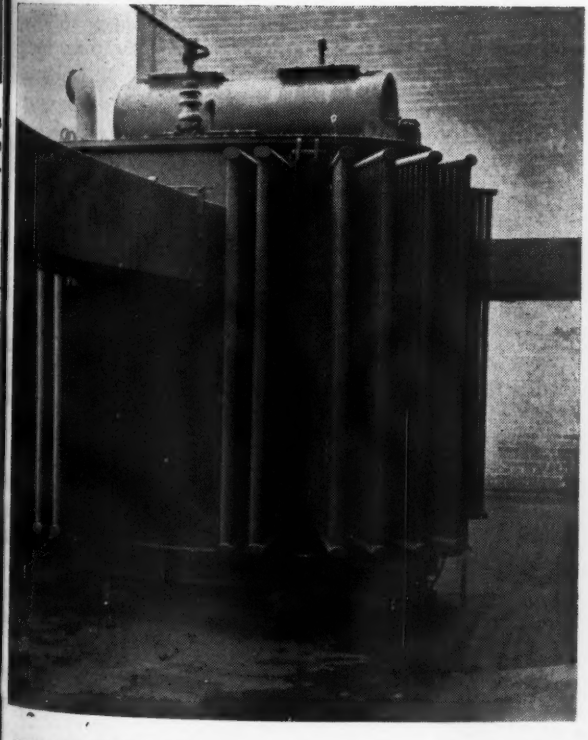
METHODS

By C. H. Mincho,
General Electrical Supt.
Harrisburg Steel Corp.
Harrisburg, Pa.

Overhead suspension of fiber duct, open wiring and load-center distribution for both power and light are features of the wiring at the Harrisburg Steel Company's new DPC plant.

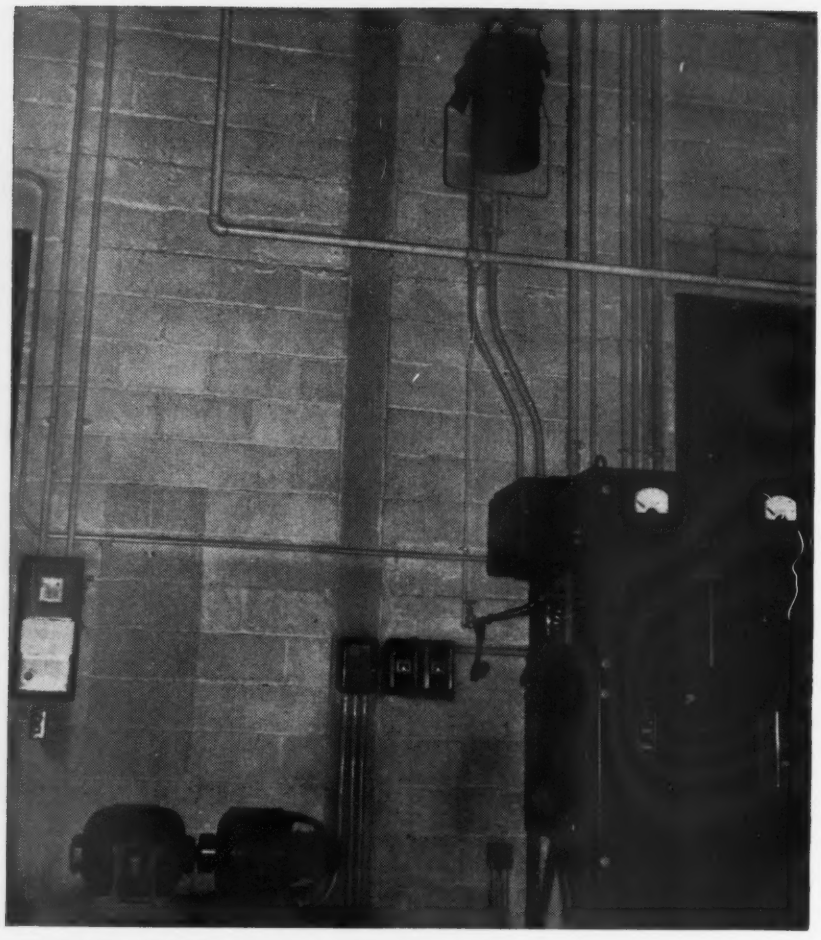


***UNIT SUBSTATION** located on main sub balcony supplies 300 kva. three phase power for the auxiliaries in the pump and compressor rooms which are adjacent. Note fiber duct risers on left.*

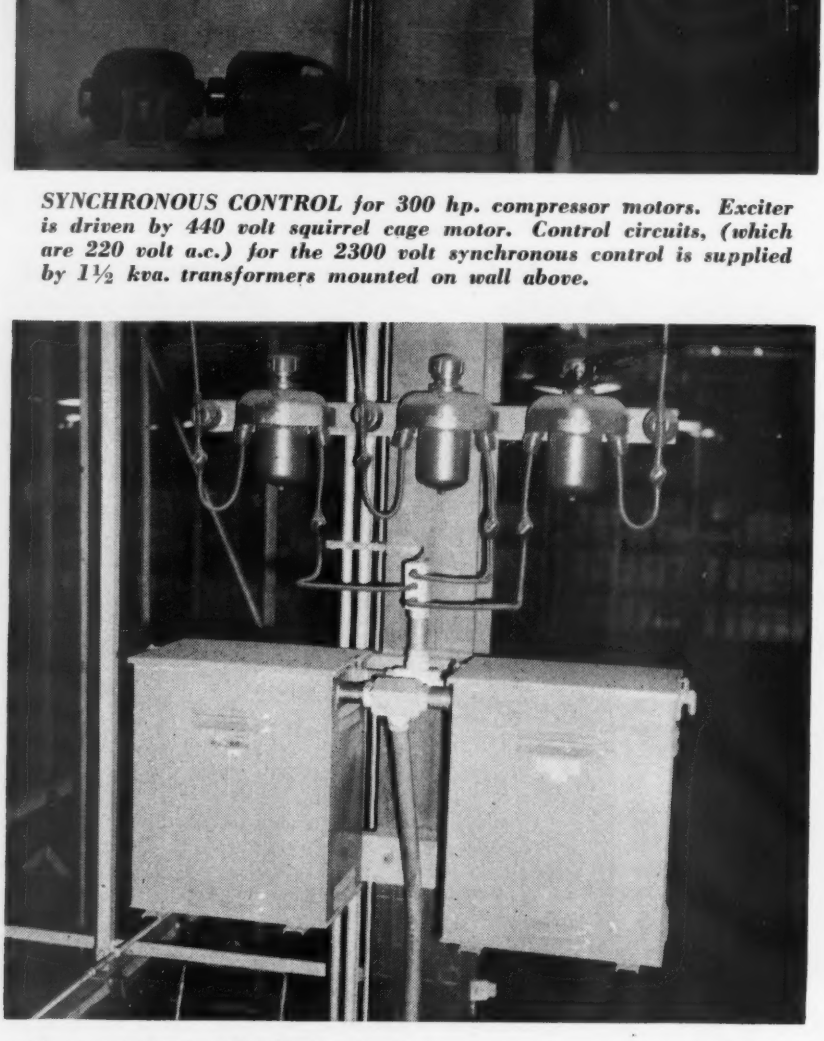


ONE OF THE 3750 kva. transformers. Note air blast fans at bottom of radiators. Metal enclosed bus coming in at left is 11,800 volt from outdoor metal-clad switchgear unit in center of concrete mat. Metal enclosed 2400 volt bus enters building at right.

METAL-CLAD SWITCHGEAR which houses the two incoming breakers, sectionalizing breaker, fourteen distribution-circuit breakers and metering cubicles. Note fiber duct risers and balcony where 300 kva. unit sub 2400/480 volts is located.



SYNCHRONOUS CONTROL for 300 hp. compressor motors. Exciter is driven by 440 volt squirrel cage motor. Control circuits, (which are 220 volt a.c.) for the 2300 volt synchronous control is supplied by 1½ kva. transformers mounted on wall above.



TWO 15 KVA. LIGHTING transformers are mounted on building columns. 2300 volt primary drops open from junction box through oil fuse cutouts. EMT risers on left of column come from panel below to junction box above where circuits emerge open to lighting units.

ers which set on either side of the switchgear. Both primary oil circuit breakers are rated 250,000 kva. 600 amps., and each 3,750 kva. transformer (11,800/2,400 v.) is equipped with automatic blowers for air blast ratings of 5,000 kva.

Metal enclosed copper bus takes the 2,400 volt secondaries directly into the building and feed the station bus at either end through 100,000 kva., 1,200 amp. oil circuit breakers. The station bus is provided with a sectionalizing breaker in the center rated also 100,000 kva. and 1,200 amps. The 14 OCB's feeding the various plant 2,400 volt circuits are all rated 100,000 kva., 600 amps. The metal-clad switchgear is made up of a total of 19 cubicles. Switchgear d.c. control circuits are supplied from the station 60 cell battery.

Distribution Feeders

The 2,400 volt feeders are so arranged on either side of the sectionalizing breaker as to provide the greatest amount of assurance against total outage.

For instance, air pressure and hydraulic pressure are two of the more important arms of production. Consequently two of the 300 hp. air compressor motors and five of the 600 hp. hydraulic pump motors are fed directly from one side of the station bus through three separate OCB's. The other two 300 hp. air compressor motors and four 600 hp. hydraulic pump motors are fed from the other side through three more separate breakers. The compressor motors are synchronous, 277 rpm., 80 percent p.f. leading, while the pump motors are synchronous 900 rpm., 100 percent p.f.

The compressor room is supplied with 2,400 volt power through circuits (3—No. 2 wire each) in 4-inch fiber ducts in concrete. The pump room is supplied by No. 4/0 wire circuits also in 4-inch fiber ducts in a concrete envelope. The 440 volt power required for auxiliaries, such as exciters, are also brought over in the 4-inch fiber ducts from the 300 kva. unit sub located on the balcony in the main substation.

Unit Substations

The main load-center substation contains two 750 kva. three-phase transformers 2,400/480 volts and is double-fed from either section of the main station bus. Five-inch fiber duct suspended overhead carry the two 800 MCM three phase 2,400 volt feeders. All overhead fiber duct is suspended

by hangers (from the building purlins) spaced on four-foot centers. Three sets of interlocked disconnects in the unit sub-switch gear permit sectionalizing in case of trouble. Two other 750 kva. substations feed from this interlock point on short spur feeds through 4-inch suspended fiber ducts carrying three 350 MCM each.

The machine shop is located on the opposite side of the main plant from the main substation. Its unit sub capacity of 450 kva. is supplied directly through the plant in underground 3-inch fiber duct buried in concrete. The feeder consists of 3—No. 4/0.

The plant lighting load is divided into two sections and fed by two 2,400 volt circuits connected to either side of the sectionalizing breaker in the main station bus. Both lighting circuits are carried overhead in 3-inch fiber duct. Each three phase circuit consists of 3—No. 4/0, 3,000 volt cable.

Lighting transformers are fed through oil fuse cutouts from pull boxes where three No. 6 leads are brought out through porcelain bushings. Transformers are mounted about 20 feet off the floor on the building columns. In general, from 15 kva. to 50 kva. (2-25's) of lighting transformers are mounted on every fourth or fifth column depending upon the division of load. Columns are spaced on 20-foot centers.

The 120/240 volt secondaries drop to a 12 or 20 circuit lighting panel. Branches go back up the column in EMT to a pull box where they emerge onto porcelain knob open wiring.

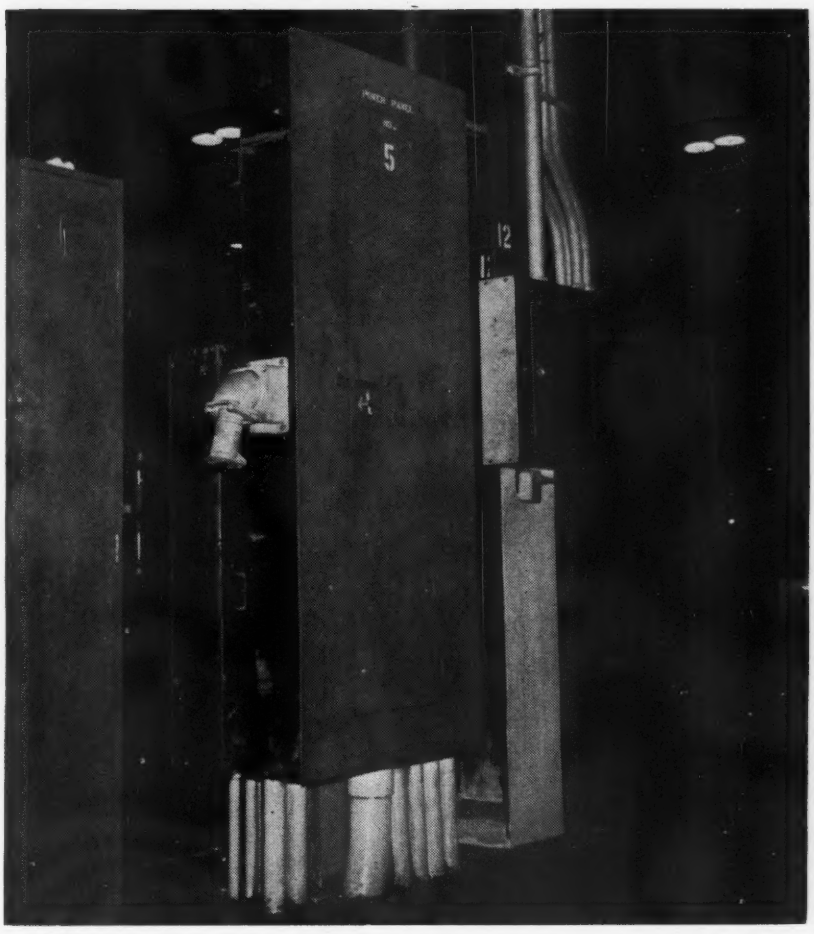
D. C. Power

Direct current power for the overhead cranes is obtained from an ignitron rectifier, 250 volt, 300 kw. The rectifier transformer is rated 2,400/250 volt, 300 kva. and is fed, through an extension of the pump room ducts which also supply the 600 hp. hydraulic pump motors.

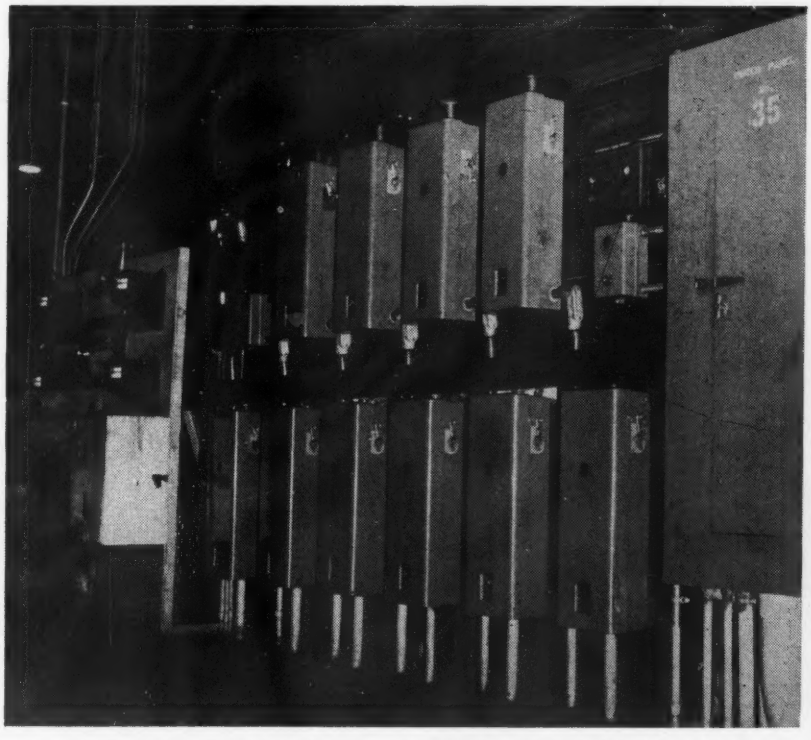
A 200 kw. standby M-G set is provided in the rectifier room. The driving synchronous motor is 2,400 volt and feeds directly from one side of the station bus. The rectifier is supplied from the other side of the sectionalizing breaker.

The system is well grounded through a ring of 20 driven grounds. Building columns are grounded to this ground ring and equipment is grounded to the steel work. Substations, in addition, are provided with multiple driven grounds to insure maximum safety.

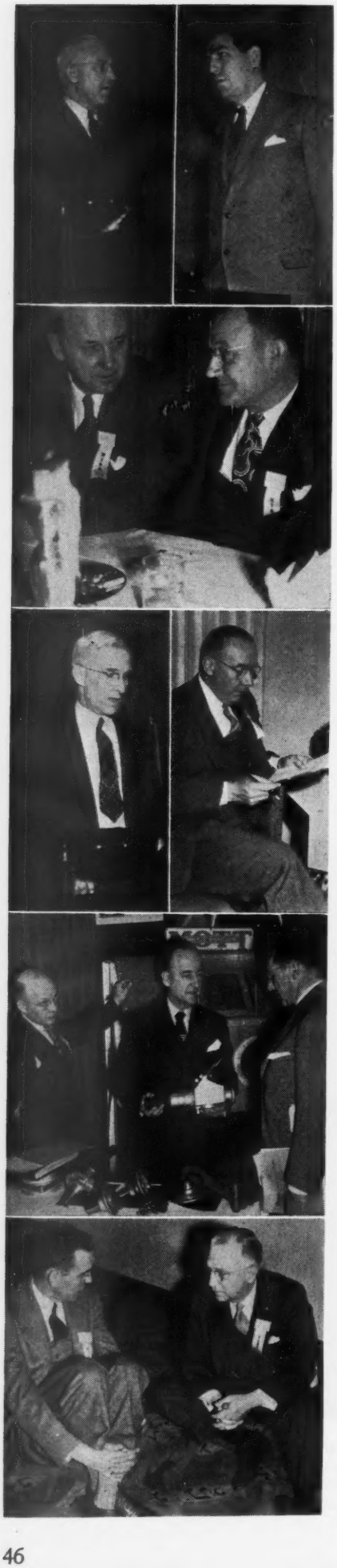
I. B. Abelson of York, Pa. was the electrical contractor.



***POWER PANEL AND LIGHTING** panel mounted side by side at building column. Note that power feeds, in and out, are underground. All conduit two inches and over is fiber duct, and under two inches is rigid steel or thin-wall metallic tubing.*



***POWER PANEL SERVING** a bank of control equipment. Fiber duct carries main feeders into bottom of panel. Square raceway emerges from top and side to carry branch circuits. Control is for heat treat-quench-draw operation on bomb line.*



NISA War C

Manpower, materials, surpluses, the small motor problem and efficient shop and management methods highlight the second NISA War Conference at Cincinnati.

THE motor service shop, today, faces the problem of expanded service with less manpower and materials. There still exists a dire need for keeping existing equipment in operating condition. Government agencies and the motor repair industry are cooperating to ease this situation.

This was the stage setting for some 300 motor service shop operators from all parts of the country as they attended the Second War Conference and Eleventh Annual Meeting of the National Industrial Service Association at the Netherland Plaza Hotel, Cincinnati, April 12th and 13th.

Manpower—the problem of the hour—does not look too bright. Recognizing the needs of the armed services, we must do the best we can with what we have where we are, cautioned L. H. Taylor, WMC, Cincinnati, in discussing the situation. One means of easing the pressure is to institute a concentrated instruction and training program, he concluded as he demonstrated an effective teaching technique.

Rugby H. St. John, Chief, Electrical and Mech. Section, Service Equipment Div., WPB, Washington, while discussing CMP regulations stressed the importance of securing proper ratings and using various supply and manufacturing sources to obtain equipment. Definite improvement in the spare parts, ball bearing and commutator situation has been made, he revealed.

A surplus of one to two million integral horsepower motors after the war was the prediction of John Gammell, chief, General Industrial Equipment Div., WPB, Washington, as he discussed redistribution. This problem is being closely studied with emphasis on the Baruch Committee recommendations that no equipment be sold or rented to speculators. Expressing his own idea, Mr. Gammell suggested the sale of such equipment to under-developed foreign countries thus extending our own standards (and possible repeat orders) and preventing a glutted market here. Original manufacturers could recondition the equipment before selling it, with a guarantee, to these countries.

Frank Willey, Cincinnati, submitted another plan whereby the government would price the surplus new equipment at a high percentage of the original cost and gradually decrease this price over definite time intervals as the demand falls off. This procedure would give the government a maximum return, control the flow of surpluses into regular trade channels at minimum economic disturbance and free government agencies from competition with established business enterprises, Mr. Willey contended.

With 33 million fractional horsepower motors on civilian appliances; with 60 percent of food requiring refrigeration and 80 percent of all laundry work done in the home, there still exists and will exist in the future a dire need for repairing small motors, advised H. F. Carr, consultant, Electrical and Mechanical Repair section, Service Trades Div., O.C.R., Washington. Action is now being instituted to raise the ceiling price on rebuilt fractional horsepower motors, he revealed.

Interpreting the Wages and Hours Acts as applied to the motor repair industry, Fred B. Wipperman, executive secretary, NISA, concluded the sessions on regulations.

About half of the Conference time was devoted to discussions of efficient shop and office methods—a vital key to the industry's war production status.

TOP TO BOTTOM—J. J. Curtin (left), Fort Wayne, Ind.; John Gammell (right), Washington, D. C.; Charles French, St. Louis, Mo.; and J. Arthur Turner, Tampa, Fla.; J. M. Chandlee (left), St. Louis, Mo.; W. J. Wheeler (right), New York; Harry R. Herold, Troy, N. Y.; C. T. Weir (center), Chicago, Ill.; and T. L. Rosenberg, Oakland, Calif.; R. Thorp (left), Kansas City, Mo.; O. K. White, St. Louis, Mo.

Conference Report

The repair of fractional horsepower motors was the subject of two comprehensive papers—one by H. E. Grant, Tennessee Electric Motor Service, Nashville and the other by M. G. Miller, operator of the Knoxville branch of the same company. Reviewing the efficient layout of a small motor department, Mr. Grant, who specializes in small motor repairs, stressed the need of proper equipment, layout, methods, trained personnel and personal supervision. To operate profitably, total investment in just essential equipment would approximate $6000 with an additional $2000 for "improvement" equipment, he revealed as he listed the type and cost of all equipment needed.

Covering the operational phases of a small motor department, Mr. Miller evaluated the importance of volume, mass production methods, and an efficient employee training program to profitable efficient operation. Since small motors are here to stay and will be repaired in the future, the industry should have enough specialized small motor shops throughout the country to meet the demand, he concluded.

"A Guide for Rebuilding Electrical Equipment" was presented to the conference by Charles Kaska, Chicago. Designed to promote a better rebuilt motor industry and prepared and adopted as their "bible", by the Central District Chapter, NISA, Chicago, the guide embodies 24 specification points covering insulation tests, bearing clearances, balance and check tests and other electrical and mechanical "rules". Motors rebuilt in accordance with this guide will be A-1 repair jobs.

Cutting production time and costs through the use of specialized shop equipment was the theme of a demonstrated talk by Arthur Wagner, Sr., Chicago. Dynamic balancing equipment, dynamometers, and other "shop kinks" were sketched and described in detail.

That time and money can be saved in office methods was dramatically demonstrated by Frank Willey and Selden High, Cincinnati, shop operators who engineered a demonstration contest between various bookkeeping

[Continued on page 168]

TOP TO BOTTOM—First Row (left to right), John E. Launder, Kansas City, Mo.; W. M. Payne, Houston, Texas; Wm. Dern; Frank Willey, Cincinnati, Ohio; Charles French, St. Louis, Mo.; and J. Arthur Turner, Tampa, Fla.; Second Row (left to right), T. R. Duncan, Augusta, Ga.; J. Arthur Turner, Tampa, Fla.; T. T. Thomas, Richmond, Va.; S. U. Steffner, Chattanooga, Tenn.; R. A. Scherer, Indianapolis, Ind.; Third Row (left to right), Jack Reddington, and Fred Ferris, Boston, Mass.; R. V. Mills and J. J. Young, Lubbock, Texas; G. E. Jones and Ed Green, Amarillo, Texas; Fourth row (left to right), H. E. Grant, Nashville, Tenn.; Harold F. Carr, Washington, D. C.; J. Roland Stolzenbach, Baltimore, Md.; Stanley Kroell, Canton, Ill.; R. O. Arber, Detroit, Mich.; and Ray F. Hornbeck, Rochester, N. Y.

SHOP TEST FACILITIES

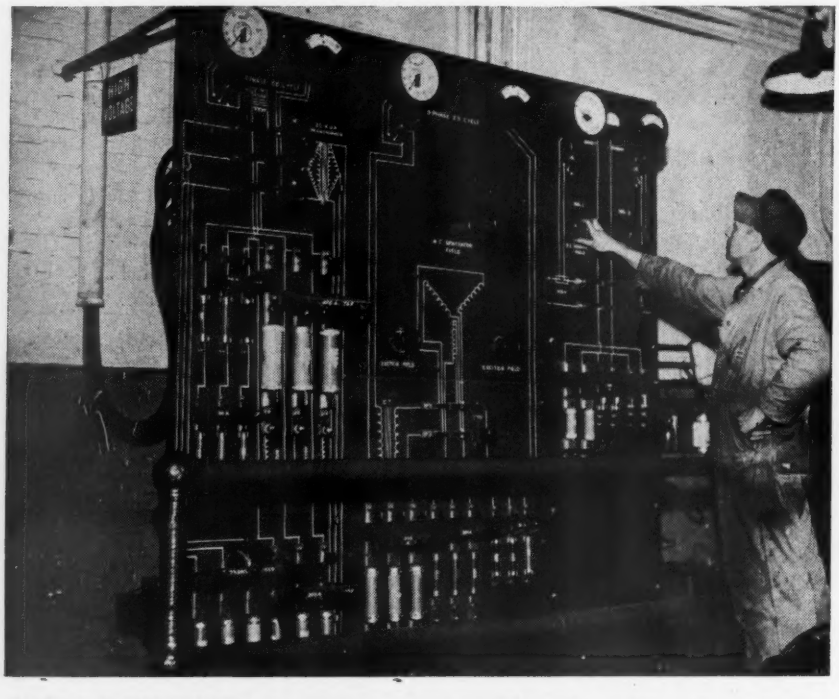
A series of small bench units and a large board for big equipment is used at Stark Electric Company in Baltimore to meet rigorous motor testing requirements.

GOOD testing equipment with plenty of capacity is indispensable to motor shop operation. Among the many improvements in motor shop technique and equipment that Chas. H. Stark put into effect, when Stark Electric Company moved to new and larger quarters recently, was that of testing facilities.

The big board which is used for running tests on large equipment supplies three separate services. Three phase, 60 cycle, 220 volts is brought directly from the incoming service to one side of the double-throw switch on the 60 cycle panel. A tap from the 220 volt terminals are taken through a fused knife switch (also on the 60 cycle panel, see photo), to a 25 kva., 440 volt, three phase transformer and on to the other side of the 60 cycle double-throw switch. The pivot terminals of the switch itself feed the terminals of the four branch circuit switches. The four test circuits are rated respectively, 30 amps., 60 amps., 200 amps. and 400 amps. The fused knife switches feed wing-nut terminals for making quick connections to equipment to be tested.

By throwing the main switch to one side or other, the tester can obtain either 220 or 440 volts at the test terminals. It also provides a convenient means of reduced voltage starting for large 440 volt motors.

The 60 cycle panel has an ammeter with transfer switch (to pick up any desired phase current) and a voltmeter.



***LARGE TEST BOARD** for running tests on 60 cycle or 25 cycle, 220 volt or 440 volt, or d.c. 115 volt or 230 volt equipment. Painting circuits on face of board is a great help to testers in making connections.*

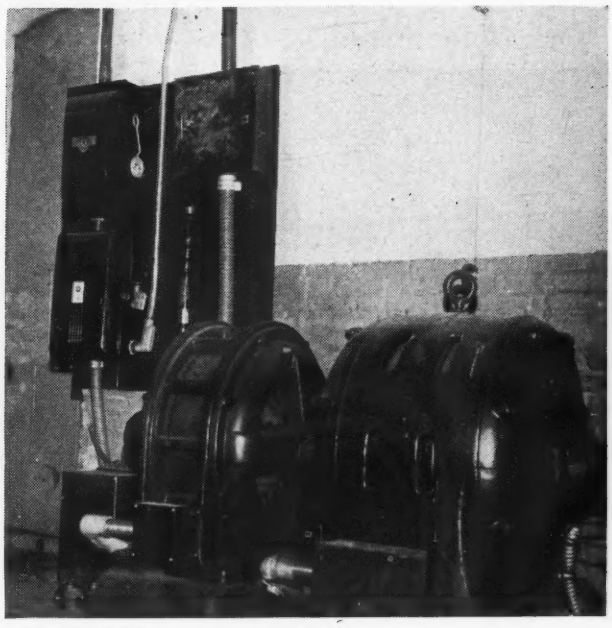
25 Cycle Panel

The 25 cycle panel is supplied from a 25 kva., 25 cycle generator driven by a 40-hp. induction motor. The six phase leads of the generator are brought to the terminals of a double-throw switch on the test board and by throwing the knife switch to the right, the generator windings are connected wye, with a resultant 440 volts. Throwing the switch to the left connects the winding in delta providing a voltage of approximately 254 volts which can be adjusted to the desired value through field control.

The three branches of test circuits are rated respectively, 200 amp., 100 amp., and 30 amp. The 25 cycle panel is likewise provided with an ammeter and voltmeter.

The d.c. panel is supplied similarly

BENCH TESTING on smaller equipment is done with units such as this. D.C. and 60 cycle a.c., 110 or 220 volts can be obtained. Note pushbutton at left side of switch.



INDUCTION MOTOR DRIVEN 25 cycle generator that provides test board with 25 kva. of 3 phase, 25 cycle power. Magnetic switch permits pushbutton control from the board.

with 115 volts and 230 volts through a double-throw switch to 200 amp., 60 amp., and 30 amp. test terminals. A voltmeter, and an ammeter for each voltage, comprises the metering on the d.c. panel. Power is supplied by two 10 kw., 115 volt d.c. generators driven from either end of a 30-hp. double-end shafted induction motor.

Complete control is obtained at the board by starting and stopping push-buttons for both m-g sets and field control rheostats for voltage adjustments.

Complete circuit diagrams have been painted on the face of the board so that the tester can easily obtain his requirements without hesitation.

Bench Panels

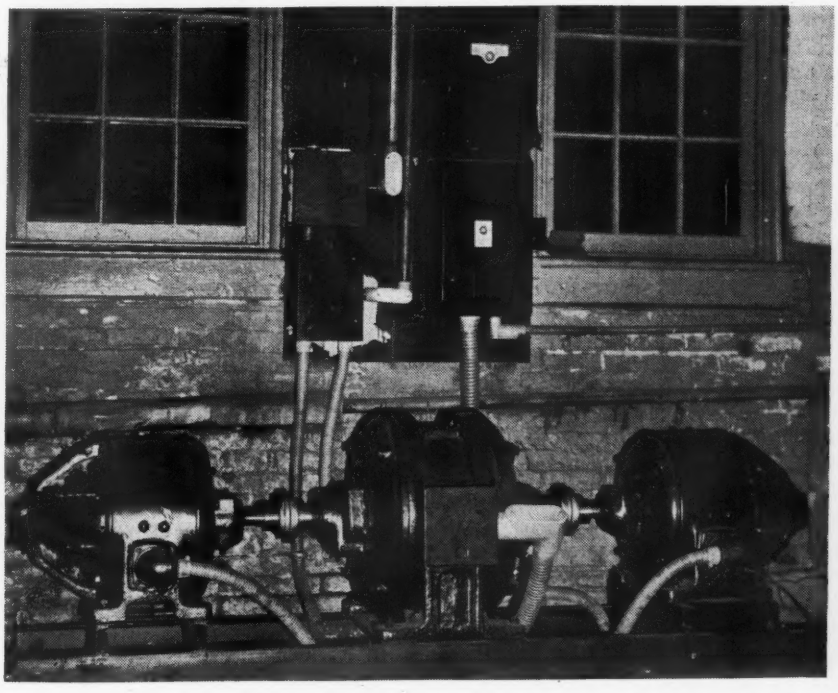
A number of small units (like the one shown in the accompanying photo) are provided at the various benches. The small panels are divided into two sections, 110 volts on the left and 220 volts on the right. In the center at the top is a neon current-indicating glow lamp. If d.c. is being supplied only half of the filament will light, but if a.c. is being supplied the whole filament will glow.

On either side of the indicating lamp are 30 amp. plug fuses to protect the test circuits. The 110 volt section is provided with six sockets (connected two in series) for either 100 watt lamps or 500 watt resistance elements. Three plug receptacles and a tumbler switch are also provided. The 220 volt section of the panel is provided with two sockets for series resistance in the form of lamps or elements, plus two polarized plugs and a tumbler switch.

A double-throw switch above the panel supplies either a.c. or d.c. at the option of the tester. A pushbutton mounted at the side of the switch permits the tester to start the m-g set supplying d.c., and to shut it off, when finished, without moving from his bench.

Small brass plates tacked to either section of the panel mark it 110 volt or 220 volt. Likewise brass plates on the cover of the double-throw switch tells the tester which is a.c. and which d.c.

This complete network of test facilities has meant much to increased production capacity of the repair shop.



TWO 10 KW. D.C. GENERATORS supply 115/230 volt test power. Push-button stations at any of the small bench test-panels or at the big board control the driving induction motor.

COLD-CATHODE

***WIRING CONNECTION** is made to the transformer through a short armored cable lead. Tubes connect directly to secondary terminals. Tube-to-tube pump opposite transformer is enclosed in metal housing.*

LIGHTING and design engineers have, for some time now, been discussing the relative merits of hot- and cold-cathode fluorescent light. This is not an attempt to join or support that debate. The purpose of this article is to try to explain what cold-cathode fluorescent is, how it operates, and how to use it.

To begin with, hot- and cold-cathode get their names from their relative operating temperatures. Actually both are hot. The cathode of the hot-cathode tube operates at about 900 deg. C. while that of the cold-cathode tube operates at around 150 deg. C. The electrode of the hot-cathode multiple fluorescent lamp consists of a coiled-coil tungsten filament cathode coated with electron emitting material and two straight wire anodes. In the cold-cathode lamp, the electrode acts as both cathode and anode and is usually a hollow, pure iron cylinder, several inches long, and may or may not be coated with an electron emitting material.

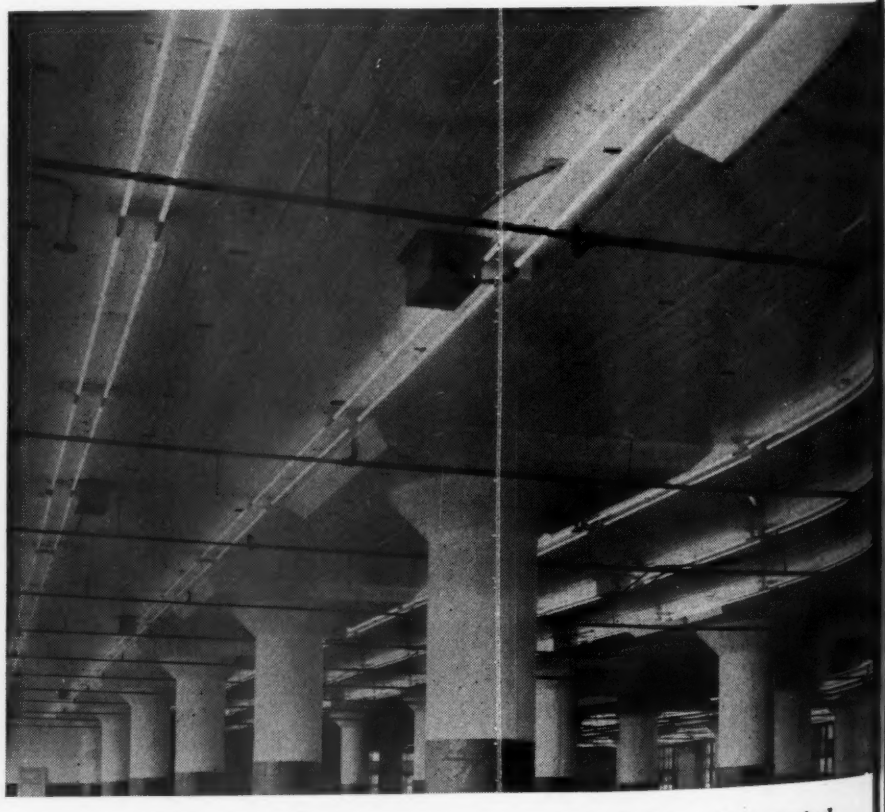
Life expectancy of the hot-cathode lamp depends largely upon how long the coating of the cathode lasts. Frequent starting tends to deactivate the cathode faster. On the other hand, cold-cathode life expectancy is determined by loss of light output as a result of deterioration of gas and coating. The cathode itself will last indefinitely.

As far as the actual illumination results are concerned, that is, the quality and quantity of light, there is little difference. Both lamps use a tube coated with the phosphor powders. Both use mercury vapor. It is impossible to differentiate between the light output of two tubes (one cold- and one hot-cathode) which are of the same diameters and operating at the same current densities. Today several lighting manufacturers are ready with designs of multi-tube cold-cathode units requiring only connection to the lighting mains and similar to the familiar hot-cathode fluorescent industrial units.

Cold-cathode installations for interior lighting involve two distinct methods, (1) high voltage series circuits operating from a special current limiting transformer; and (2) special circuits in which pairs of lamps work from balanced power factor correcting auxiliaries. In the first method, a common practice is to install 12 cold-cathode lamps or their equivalent in tube length on one transformer. The starting voltage available is in the order of 12,000 volts and current in the order of 100 milliamperes. In operation the voltage across each lamp is approximately 450 volts. As with any other arc source of light, the current must be controlled and in the series circuit this control is inherent in transformer design which carries a short circuit secondary current rating slightly higher than operating ma.

For a given tube diameter, as the current through it increases, the current density increases, the brightness increases and the lumens output increases. The disadvantages of the increased currents are that increased brightness might be objectionable and further high current densities will depreciate the phosphor powders and gas faster, thus reducing life expectancy.

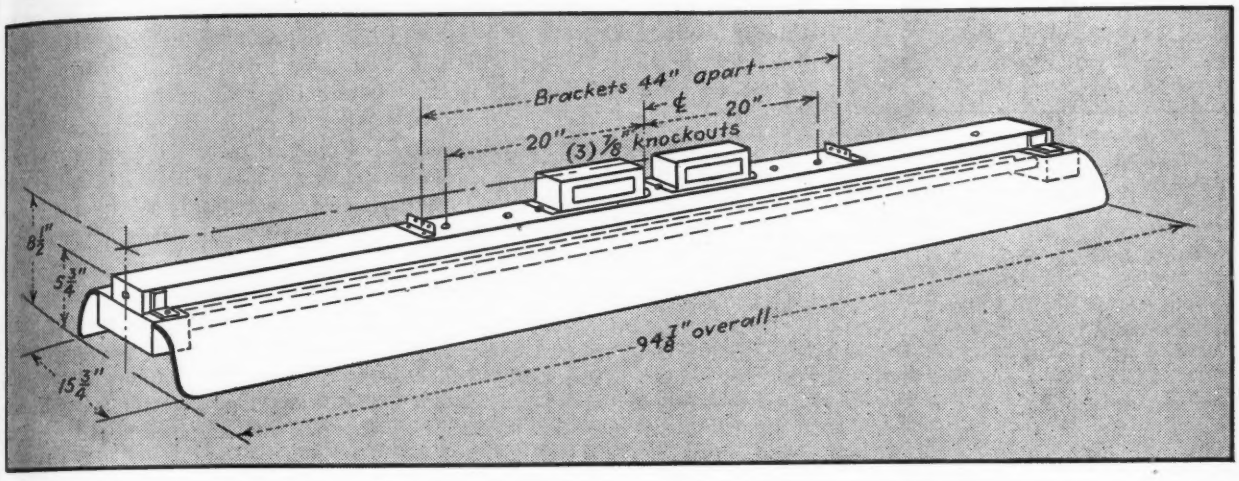
Each pair of electrodes in a cold-cathode tube has a definite voltage drop for any definite current. Assume that a 25 mm. tube operating at 100 ma. has a voltage drop of about 300



***SERIES HIGH VOLTAGE** fluorescent cold-cathode lighting in a typical installation. Tubes are spaced 6 inches apart. Each secondary circuit feeds 12 lamps each 7-ft. 9-in. long.*

LAYOUT

A discussion of the fundamentals and operating characterstics of cold-cathode fluorescent lighting and its application.



	Approx. Spacing in Feet	Area Per Fixture Sq. Feet	Mounting Height Above Floor	Room Finish Walls & Ceiling	AVERAGE FOOT-CANDLES ROOM PROPORTIONS Large Industrial Width = 4 x Mt. Hght.	Average Industrial Width = 2 or 3 x Mtng. Hght.	Average Small W = Mtng. Height
Continuous Row Spacing	8' x 8'	64	8' to 10'	Light	105	100	86
				Medium	99	94	80
				Dark	95	90	75
	8' x 10'	80	10' to 12'	L	85	79	66
				M	80	74	60
				D	77	72	57
	8' x 12'	96	11' to 14'	L	70	63	55
				M	66	60	51
				D	64	57	48
	8' x 14'	112	13' to 16'	L	59	54	45
				M	55	52	41
				D	53	49	38
	8' x 16'	128	15' to 18'	L	50	46	37
				M	47	44	34
				D	46	41	32
	8' x 18'	144	17' to 20'	L	44	39	31
				M	41	37	29
				D	39	35	27
Individual or Group Spacing	16' x 10'	160	10' to 12'	L	42	39	33
				M	40	37	30
				D	38	36	28
	16' x 12'	192	11' to 14'	L	35	31	27
				M	33	30	25
				D	32	28	24
	16' x 14'	224	13' to 16'	L	29	27	22
				M	27	26	20
				D	26	24	19
	16' x 16'	256	15' to 18'	L	25	23	18
				M	24	22	17
				D	23	20	16
	16' x 18'	288	17' to 20'	L	22	19	16
				M	20	18	15
				D	19	17	14

4 Cold Cathode Lamps Total Lamp Lumens: 8800
Light Output in % of Bare Lamps: 82.3%

Maintenance Factor Not Included in Above Figures
Average Should Not Be Assumed Higher Than .70

***AVERAGE ESTIMATED** foot-candles for standard spacings of typical 4 c-c lamp lighting units. Figures and dimensions given are for the Mitchell "Kold-Volt" unit No. 2081.*

WARM WHITE LAMPS		
Mm. diam.	Mil amps.	Lumens per ft.
18	40	143
	45	158
	50	174
	60	210
	90	305
	100	326
	120	383
22	60	192
	90	279
	100	298
	120	350
	150	425
	155	436
	160	452
	165	462
	170	473
	175	486
25	60	161
	90	232
	100	250
	120	290
	150	353
	175	398
	180	412
	185	417
	190	424
	195	430
	200	435

Secondary Voltage	Number of tubes	Watts input
2000	2	90
4000	4	175
6000	6	300
7500	8	390
9000	10	475
12000	12	600

Operating at 120 milliamperes (short circuit rating) the transformers will supply the shown number of 20 mm. 7-foot 9-inches tubes. Primary voltages can be obtained at 110, 220 or 440 volts to suit the requirements of the installation.

volts. If a short tube is used requiring 700 volts for striking, the electrode voltage drop is a greater percentage than if a longer tube were used requiring 1,000 volts to strike the arc.

The striking voltage of a 12,000 volt circuit operating 12,7-ft. 9-in. tubes in series is about 12,000 volts (this is the peak kick-off voltage) and will then operate at an rms value of around 6,500 volts. Most transformers have a midpoint tap to ground in the secondary which gives a peak volts-to-ground of around 6,000 volts for the 12,000 volt transformer referred to above.

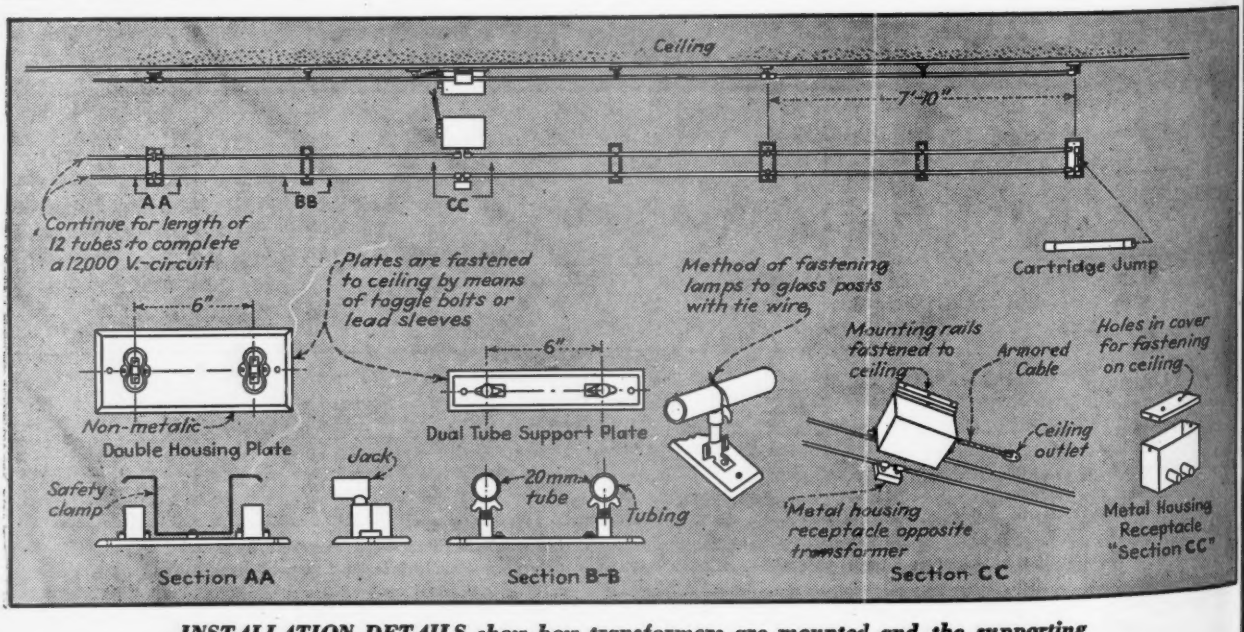
Balanced transformers have been developed which will operate two lamps in multiple with about 900 volts initially across each tube and will supply required currents in the order of 30 to 120 milliamperes for tubes ranging in diameter from 20 to 25 millimeters. For a four tube reflector unit, two of these transformers are necessary. The transformer is about the size of the present two lamp ballast used on hot-cathode units. When large scale production begins, manufacturers expect that an 8-foot unit using two tubes will be comparable in price, efficiency and light output to a four-foot hot-cathode unit using two 40-watt lamps.

Layout and estimating methods for cold-cathode installations are similar to those employed for figuring hot-cathode fluorescent jobs. Factors of lumen output, coefficient of utilization and maintenance must be considered.

Installations of open tubing on series circuits on the ceiling or in coves will have the same coefficient of utilization considerations as bare hot-cathode fluorescent or incandescent lamps. Lumen output is usually given in lumens per foot of lamp. The maintenance factor selected will depend upon the surrounding conditions. However, it is important to note that if the unusually long life of cold-cathode lamps is to be utilized, the decline in light output over the selected life span must be taken into consideration in estimating average foot-candles to be expected in service.

Standard industrial lighting fixtures involving assemblies of cold-cathode lamps in a reflector are figured in the same way as the familiar industrial hot-cathode fluorescent units. The same special consideration for light output depreciation during long lamp life mentioned above also applies to these units. Foot-candle tables have been developed by the manufacturer for their industrial units and a typical set of figures are given here applying to the Mitchell "Kold-Volt" unit.

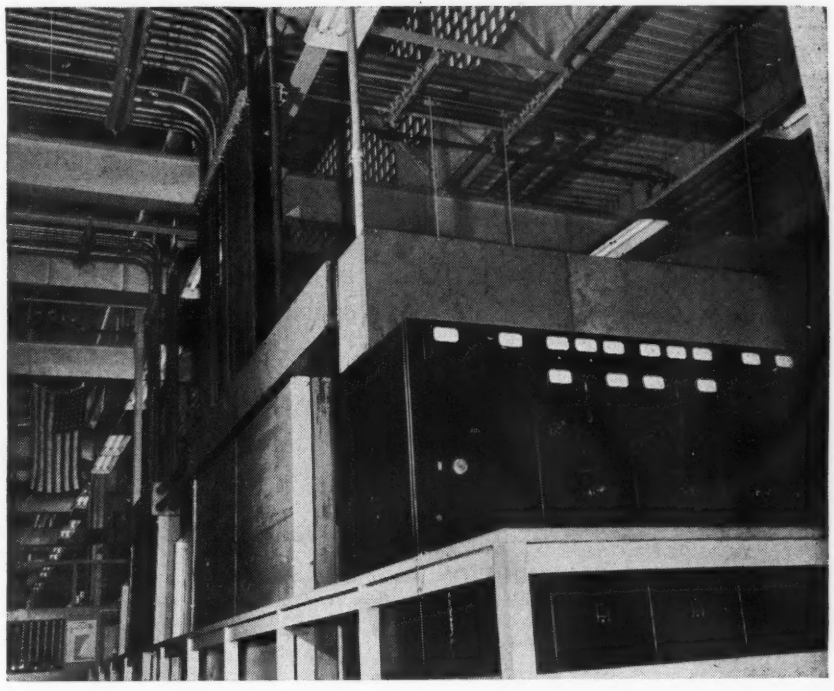
The trend in cold-cathode fluorescent lighting seems to shape up somewhat like this. Two- and four-lamp units for all types of commercial and industrial application (lengths not yet standardized but will probably be somewhat less than eight feet) will be put into large scale production. This will bring price down. Efficiencies (lumens output per watts input) are expected to be as good as hot-cathode units. Life expectancy and instant starting are favorable to cold-cathode but the question has arisen whether light depreciation over 8,000 hours burning life can be tolerated. Lumens output per fixture can be calculated and layouts and installations can be made as they are for the hot-cathode units.



INSTALLATION DETAILS show how transformers are mounted and the supporting devices for the tube circuits. The items shown are those of Colonial Lighting.

Wiring for Critical Testing

To meet the rigid specifications for testing aircraft control equipment, Sperry Gyroscope has installed an extremely flexible distribution system for mass production testing.



***SEVERAL CUBICLES** of the metal-clad switchgear can be seen in foreground. D.C. panel and high-cycle panel are seen on left. Note the four 3-inch conduits connecting a.c. and d.c. wiring troughs. Note also large wiring trough above cubicles.*

AUTOMATIC gyro-pilots and other aircraft control equipment manufactured in Sperry Gyroscope's new Nassau plant undergo very rigid final acceptance tests. Aircraft operating conditions must be simulated and therefore a multiplicity of electric power services are required. The test benches which carry on the mass production break-in-calibrate-test procedures are supplied with four separate electrical services: 115 volt, 400 cycles; 60-70 volt, 200-300 cycles; 27½ volt d.c.; and single phase—three phase, 120/208 volt, 60 cycles.

Generating Equipment

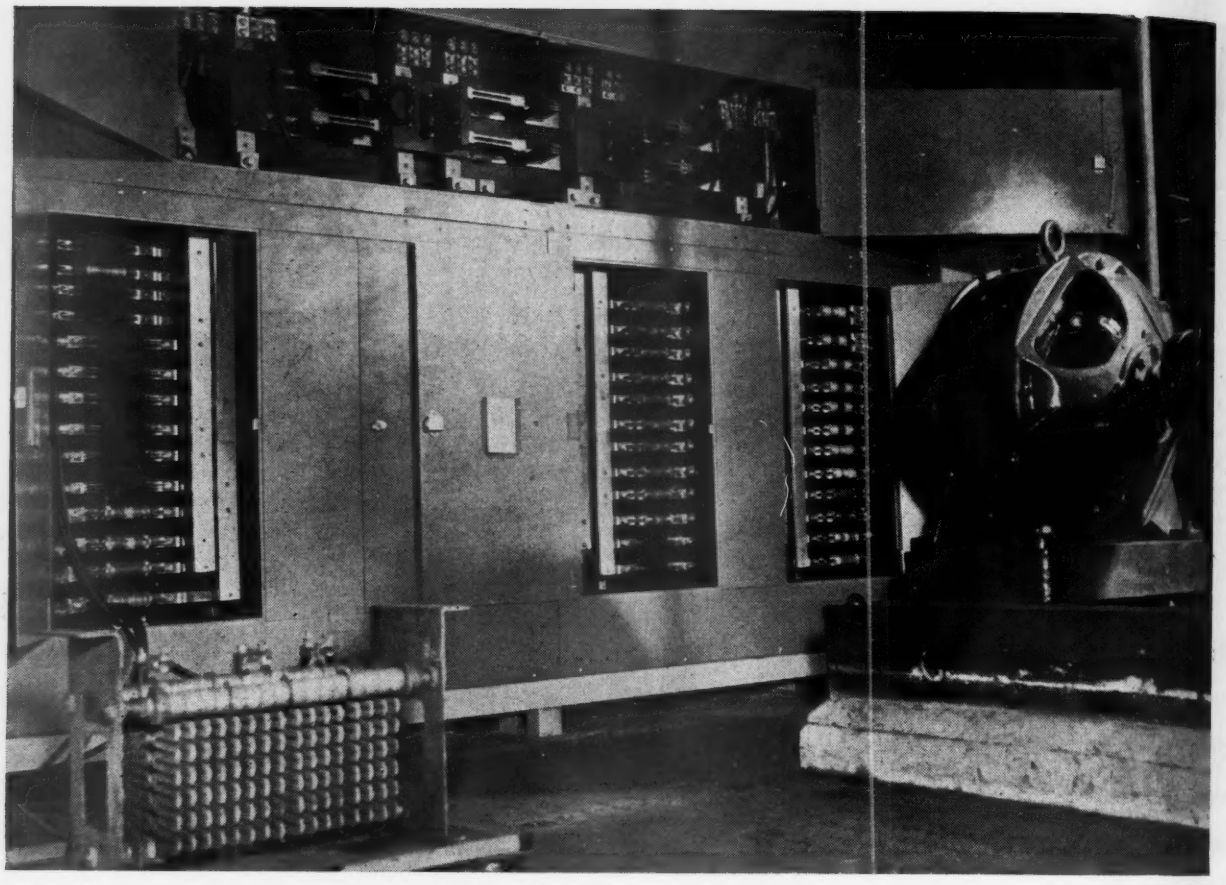
The generating equipment and the panels are shown in an accompanying diagram. The wide variety of generating sources result from test procedure requirements. First of all the aircraft control equipment must be broken-in. This may take several hours or several days. During this break-in period the 27½ volt d.c. is supplied by induction motor driven m-g sets. A half volt either way during this period makes no difference. However, after the equipment is broken-in, it must be calibrated, and calibration requires precisely 27½ volts d.c., no more or no less. A fraction either way may result in complete re-calibration and re-test. Then following a company test, government test engineers run a final acceptance test. For all these latter operations, precise d.c. voltage is obtained from the battery units.

The same holds true on the high cycle aircraft equipment. For break-in, a variable frequency (350 to 450 cycles at 115 volts, and 200 to 300 cycles at 60 to 70 volts) is supplied to the test benches. The same source is used for calibrating and testing the 200 cycle equipment which is not so critical; but a synchronous 60 cycle motor drives a synchronous 400 cycle generator at 115 volts for the calibration and final test of the 400 cycle aircraft control.

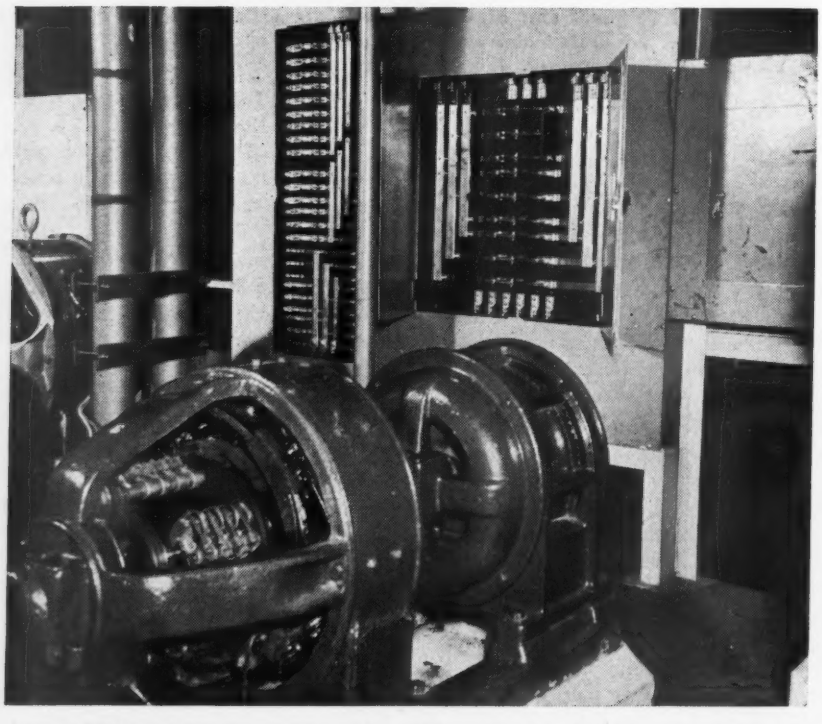
In the accompanying diagram of the generating "room" (which is a fenced-in area in the heart of the testing section) is shown the 12-cubicle metal-clad switchgear. Atop the cubicles is a large trough (running the entire length) to carry the heavy circuits to the distribution panels located behind the cubicles facing the machinery.

Two groups of telescoping conduit emerge from the cubicle trough carrying driving-circuits out and generated-circuits back to the switchgear. The conduits are carried on trapeze-hangers slung from the ceiling. The various generated circuits are measured at the control cubicles for amperes, volts and frequencies before going to their various distribution panels.

Only six men are permitted to enter the generating area for any purpose whatsoever—three test engineers and three maintenance electricians. Jack Massell, chief electrician, has placed a log book on the control board for permanent record. If a test engineer



***D.C. 27½ VOLT DISTRIBUTION** panel with three tie switches and jumper. At time picture was taken, emergency condition existed requiring use of jumper. Resistor unit (lower left) required to stabilize generator.*



***THE TWO OPEN PANELS** are for 400 cycle, three phase distribution. Synchronous 400 cycle feeds bus to left of double throw switches while 350 to 450 cycle variable frequency feeds bus to right of switches. Panel on the extreme right distributes 200 to 300 cycle variable frequency at 60 to 70 volts only to certain areas.*

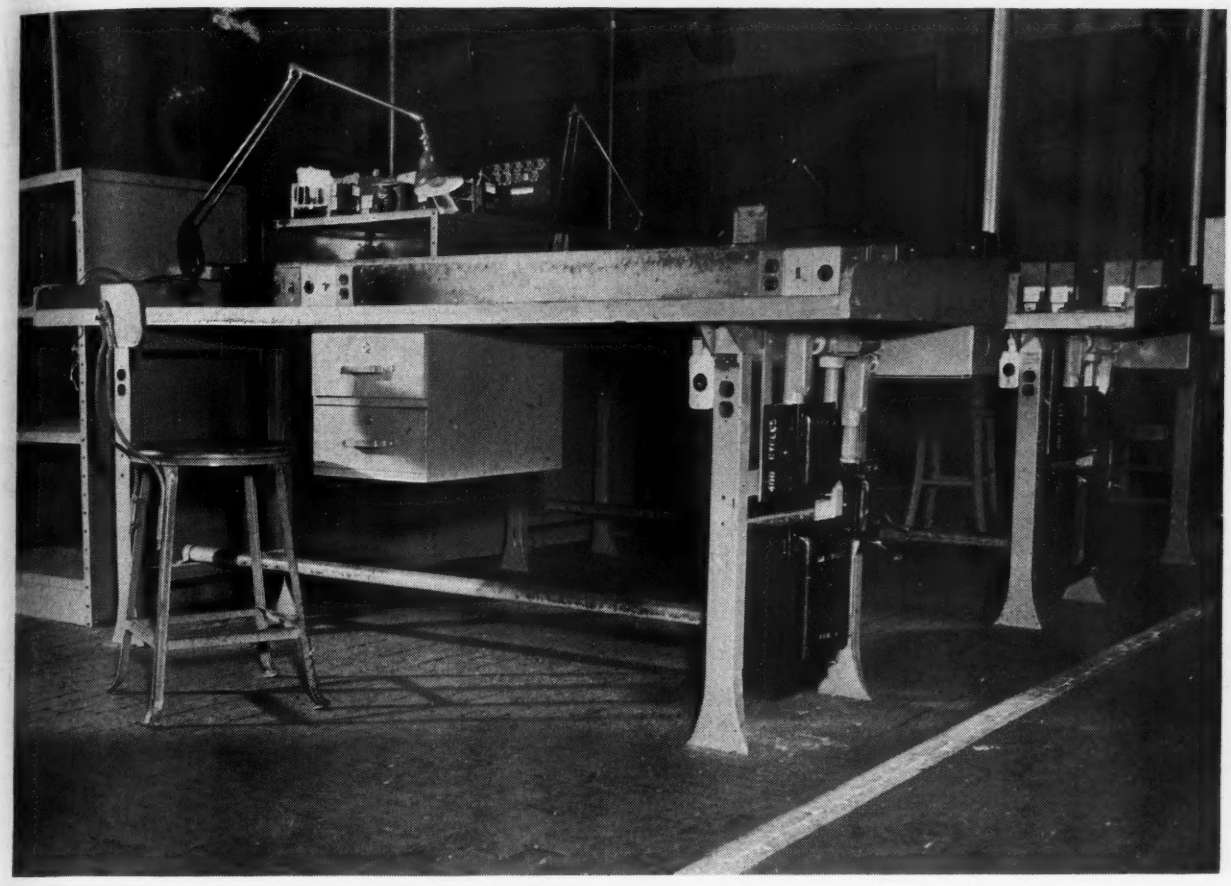
makes an adjustment, or if an electrician enters for inspection, maintenance or repair, each must enter into the log book exactly what was done, who did it, and time and date. This again emphasizes the criticalness of exact power requirements.

Distribution

The d.c. panels are fed from three different sets of rotating machinery and two separate battery sources. Above the four distribution panels is mounted a set of three tie switches plus a jumper. With these switches and the main generating circuit breakers in the cubicles, a very flexible distribution system is obtained. Any panel can be thrown onto any generator or battery, or the total load can operate from any one source in an emergency.

The 400 cycle panel is provided with double-throw switches. The synchronous 400 cycle fixed frequency feeds the one bus, while the variable 350 to 450 cycle generator feeds the other (see picture). Thus by throwing the double-throw switches, the test benches in any area can obtain a fixed or variable frequency. In emergencies, either source can carry the total load.

The 200-300 cycle feeds directly



TEST BENCHES showing conduit drop to pull box mounted beneath bench-top. Circuits go through fused disconnect switches and up to wiring trough which runs length of bench. Receptacles are mounted in trough side.

through the 200 cycle panel to the test benches requiring that particular service.

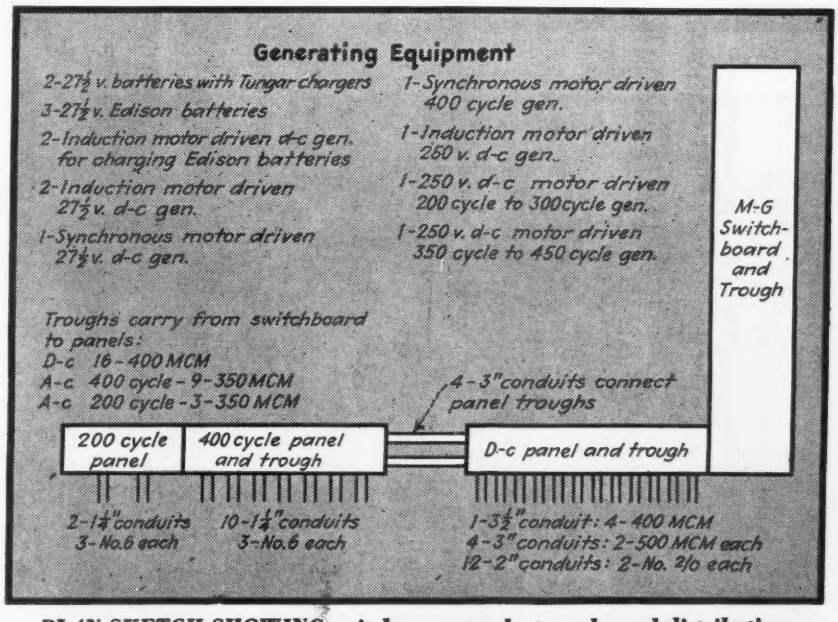
All the wiring has been installed purposely heavy to reduce voltage drop to an absolute minimum, for the test bench receptacle voltage must be exact within a very small fraction, and must not vary as load is applied.

The resistor bank seen in one of the accompanying pictures is a loading resistor drawing approximately 75 amps. to give the 27½ volt d.c. generators stability during light-load periods. Otherwise, voltage variation would be excessive.

Test Benches

Conduits rise from the distribution panels, fan-out over the testing area, and drop from pull boxes to the various test benches. The conduit terminates in a pull box mounted on the underside of the test bench. All services are brought into the same box above by separate conduits. However, the various services that go to any particular bench are brought down in the same conduit. From the bench pull box, the various circuits go through their respective fused disconnect switches and on to receptacles. A wiring trough runs the entire length of the bench and provides in addition to a raceway for the wires, a convenient mounting panel for the receptacles and their tumbler switches. The trough also acts as a backstop for the bench and does not protrude over the back edge.

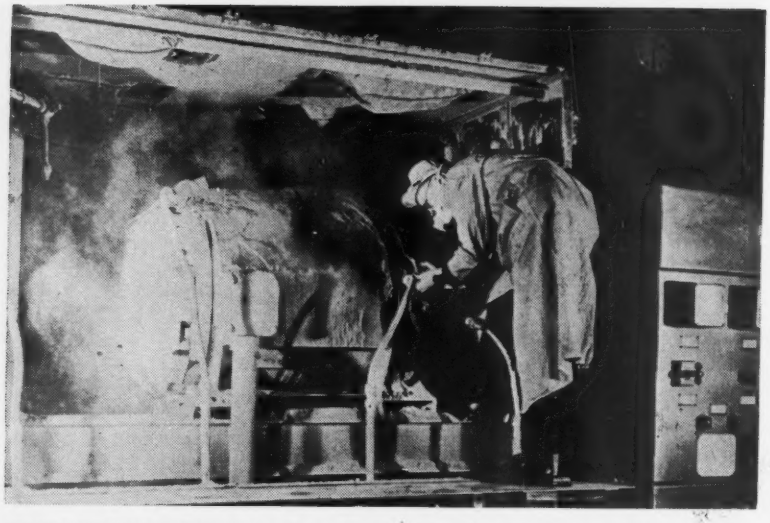
The 60 cycle service is also supplied through the same conduit as are the test services. Three phase, four wire 120/208 volt service gives the tester use of any type of hand tool whether single or three phase. By having the four wires at the junction box, the face plate of the receptacle can be changed to accommodate either single or three phase without pulling additional wire.



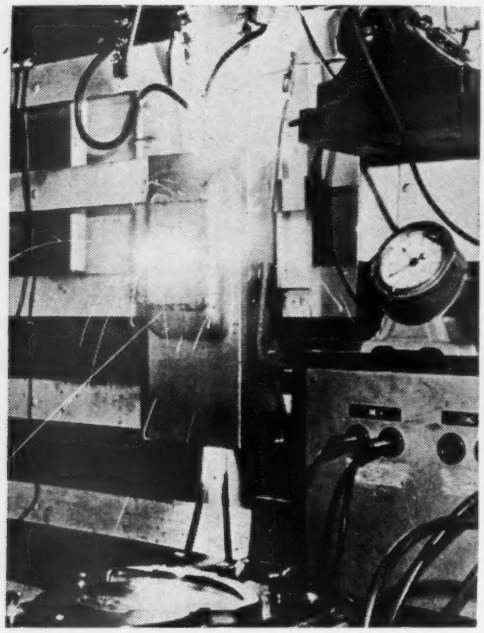
PLAN SKETCH SHOWING switchgear, panels, troughs and distributing conduits. Generating equipment, cable and conduit sizes are as noted.

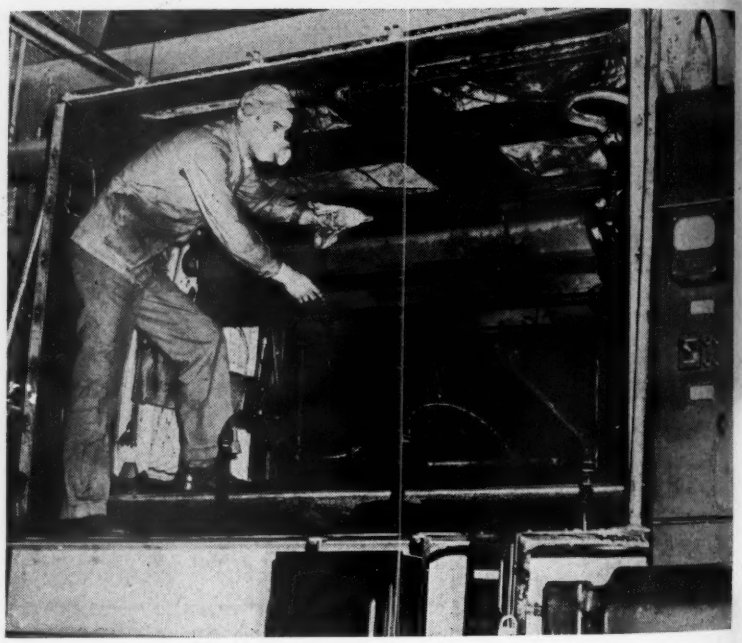
FIFTY Y

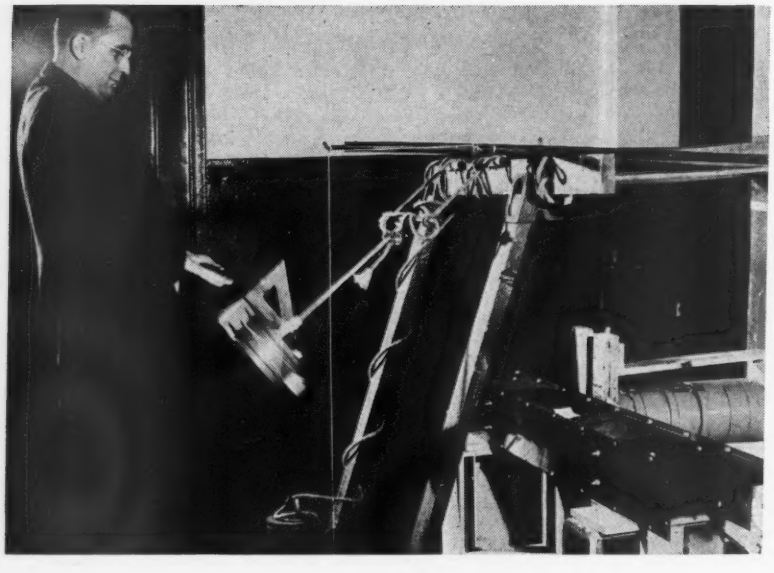
Underwriters' Laboratories, Inc. rounds out a half century of safety service to the public. Its "know by test" philosophy and scientific development of safety standards has fostered public confidence and acceptance of electricity as a servant.



DUST TIGHT MOTOR is given a 10-day, full load, dust-tight and overheating test in UL dust chamber. Test results determine motor's suitability for use where grain dust, flour and the like are present.







Above

***FLUORESCENT FIXTURE** of dust-tight type is tested for use where coal, coke and other carbon dusts are present. Ten-day test with carbon black blown against vulnerable points and thermocouples to record heating, duplicates months or years of operating conditions.*

Upper Left

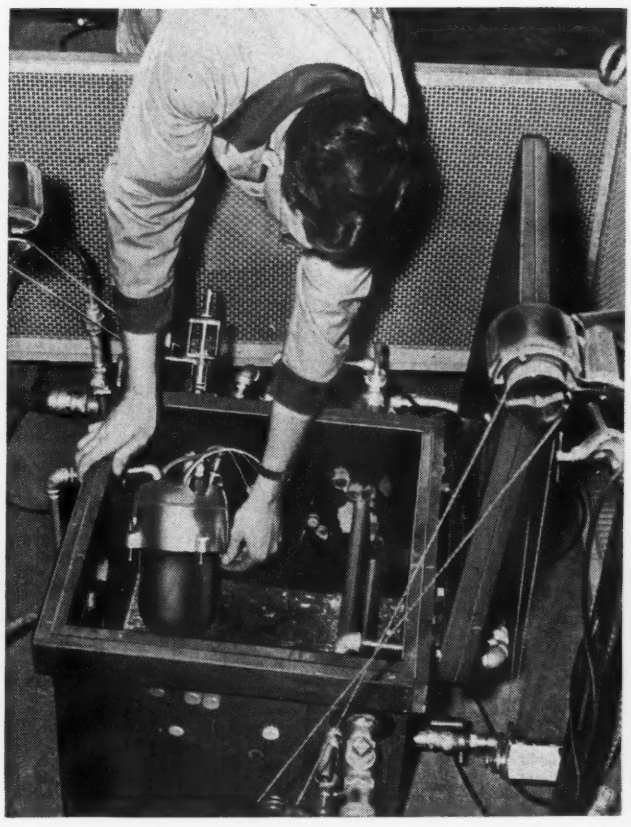
***OVERLOAD TESTS** at 150 percent rated current are given electrical switches. Severe arcing of this unit caused molten copper to be thrown through openings in switch case.*

Left

***BUSWAY IMPACT TEST** determines resistance of emergency 20 gauge sheet metal housing against impact damage. A 50-lb. weight on a 30-inch radius and swung through a 60 degree arc supplies the damaging blows.*

YEARS of SAFETY SERVICE

WIRE LABORATORY conducts exhaustive tests on conductor insulations. Oven, oxygen bomb, chemical, accelerated aging, carrying capacity and other tests complete the testing cycle for all types of wires, cables and cords.



EXPLOSION-PROOF TESTS on electrical equipment are made in this laboratory. Here, both fixture and wood box (representing factory area) are filled with explosive gas mixture. That in fixture is ignited and housing must confine explosion and not explode gas.

THE Columbian Exposition of 1893, Chicago's first World's Fair, marked the debut of a lavish display of incandescent electric lighting—fresh out of Edison's laboratory. Unfortunately for the Fair, but fortunate for the future of the struggling electrical industry, a number of fires—some caused by this "new-fangled" lighting—developed. Boston insurance interests sent an engineer to investigate. Out of it developed the realization that, unless properly controlled and used, electricity was hazardous to life and property and that some means had to be found to determine safe limitations for equipment used to harness this newly developed source of energy.

Thus in 1894, Underwriters' Laboratories, Inc., was organized with William Henry Merrill, the investigating engineer, its founder-president. Three years later the first edition of the National Electrical Code—the "Bible" of every electrical man—was drawn setting forth rules and regulations for the installation of equipment approved by the Laboratories. The combination of these media provided a set of standards that correlated the few scattered regulations then existing and provided manufacturers with a single set of test specifications which their equipment must meet to be considered safe. Without these, public reaction to a potential hazard may never have permitted the electrical industry to attain its present day position.

Since its inception, Underwriters' Laboratories, Inc., has come a long way. Its first home, complete with about $350 worth of electrical equipment, was a one room laboratory above a Chicago fire station. Today, the main testing station and headquarters in Chicago—one of the best examples of fire-resistive construction in the world—covers 130,000 sq.ft. of floor area for 17 departmental laboratories. Three additional testing stations complete the picture—one in New York City handling electrical, fire alarm and burglary work; one in San Francisco handling primarily electrical work; and a high explosives testing station in the open country some 35 miles from Chicago. Total testing station equipment, buildings and land now approximate one and one-half million dollars—a far cry from the original fire house laboratory in 1894.

Field service is provided by technical inspectors emanating from branch offices in 185 cities in the United States and Canada; London, England; and Hilo and Honolulu, Hawaii. These men annually make some 85,000 visits

[Continued on page 167]

EDITORIALS

W. T. Stuart, *Editor*

Repairs Cut New Requirements

Fractional horsepower motors are among the most critical components in war industry. They are used by the dozens on every bomber and fighter and by the hundreds on every ship. Critical war industries use them by the thousands. The numbers that are available for even the most urgent civilian repairs are nowhere near enough to supply the need.

Every fractional horsepower motor that can be repaired and placed back in service is, consequently, urgently needed to keep the home front supplied. It has been estimated that about three million motors will require repair this year of which about one million will involve major repairs such as rewinding.

Frictional horsepower motor repair is a highly specialized job. Shops which have worked out successful and economical methods invariably set up a separate department with specialized tools and routine. Other shops, without such specialized equipment and with storage space already piled high with waiting work in the integral horsepower sizes, have been reluctant to tackle the added burden of fractional repairs. And price ceilings further discourage those who would like to help fractional horsepower repair needs.

While there is little prospect of relief in manpower, an overhauling of the price ceilings is entirely practical. A better chance for profitable operation would bring more shop facilities into the urgently needed fractional horsepower repair field.

Awards Stimulate New Thinking

During the past year a committee of the National Industrial Service Association has been studying and rating suggestions for new shop practices from employees of member shops over the country. Three awards were made at the annual meeting of the organization in Cincinnati last month. The program and awards will be continued to stimulate better shop methods.

It seems to us that the NISA award plan fills a real need in the motor shop field. Recognition to the man in the shop is good for the progress of the industry and stimulates others to use their genius and special talents to improve their own methods.

The NISA award is a splendid project, fairly and expertly administered and brings practical benefit to the whole industry.

Hear The Farmer

There is a keen appreciation of the vast postwar market awaiting development in the rural electrification field. The electrical industry is realizing that it has just scratched the surface of this market that represents approximately 20 percent of its customers. Private utilities predict they can build 40,000 miles of rural lines serving 175,000 farms immediately materials are released. REA plans will boost this mileage. The eventual goal is to reach the 3½ million non-electrified farms in the United States today and to promote improvements on the existing 2½ million electrified farmsteads.

To reach this goal one salient point must be carefully considered. The farmers' problem is different. Farm wiring and equipment are not housed in well heated, controlled condition areas as in industry and urban applications. Geographical location and the products of the specific farms are important factors affecting the use of electrical equipment in rural areas. Equipment made for industrial and urban areas will not always work on farms.

Who then can best advise manufacturers as to the farmers needs? None other than the farmer himself—through the numerous agricultural experiment stations, the American Society of Agricultural Engineers, state and local farm groups where electrical problems can be aired. Minnesota took the lead in this respect when they organized the Rural Electrical Equipment Council of the North Central Electrical Industries where the manufacturer, the engineer, the electrical inspector, the electrical contractor, the distributor and the farmer himself can meet to discuss the needs for new equipment or improvements on existing electrical farm equipment.

We need more of this, not only on a national or state basis—but on a local basis in each farm area. These local industry representatives should get together with the local farmers at a round table or in the village store to discuss their electrical needs. Out of it will come the suggestions and ideas manufacturers will need to produce equipment that will stand up under rigorous farm conditions; that will serve the farmer best.

If we are to reach and saturate this vast farm market, the farmer must be heard.

Watch The High Cycle Field

The operation of wood-working machinery and some automobile assembly tools on alternating current frequencies higher than 60 cycles has been a well known utilization of the "hi-cycle" spectrum for many years. By generating at higher frequencies the 3600 r.p.m. limitation of a two pole motor at 60 cycles can be eliminated and much higher speeds obtained. The simple and sturdy squirrel cage motor design can be employed and comparatively high hp. ratings obtained in units which are physically tiny.

High speed with compact and light motors is however only one phase of the potentialities in hi-cycle that will find inevitable development in postwar industrial processes. Induction heating is another. Welding methods now in use employ electronic tubes to give "shots" of an accurately controlled number of cycles. These thin metals can be welded without burning. The thyratron, however. could dole out one cycle of 600 a second quite as precisely as one of 60. The impact of electronics on industrial apparatus may

rapidly stimulate many new applications in the years to come.

And as hi-cycle finds broader use it must inevitably affect wiring. Reactive impedance becomes a considerable factor inviting the development and application of distribution methods designed for minimum reactance losses. The wiring demands expert and skillful installation. It's a field to watch.

Advertising The Contractors Service

A strong promotional campaign to sell the services of qualified electrical contractors to industry and business executives has been proposed to the membership of the National Electrical Contractors Association. It has now gone out to the Chapters for ratification. The plan proposes a series of advertisements in important business and technical journals reaching top management men in the construction industry and in the factory.

The campaign and the media selected is well thought out. And right now it is vitally important to get the contractor's story before every business man concerned with reconversion and postwar problems. The proposal plan should be given the green light and full support from every member.

Foreign Service

A number of American electrical contractors have handled important jobs in distant places, many of them highly secret, all of them involving new problems of material and labor supply and unusual working conditions. When the time comes for our country to take a greater part in world commerce—and it is inevitable that we shall—the experience of these firms will provide a strong foundation for handling work in foreign lands.

The prospect of foreign work is one that should be considered very seriously in our postwar planning. American construction methods have impressed the world. And the extensive use of construction machinery makes direct competition with other nations entirely practical.

If American electrical wiring materials and apparatus are to take a leading part in postwar reconstruction over the world it is logical that American electrical contractors will carry their specialized methods to other lands.

Let's Have A White List

Jobbers who sell to anybody with a letterhead at contractors cost have been standing in the way of a clear cut distribution policy too long. It was to be expected that wartime scarcity and priorities and price control would correct the practice. But it goes on. And it will continue to rise up and confound our plans and policies until we are willing to recognize it for the great evil it is and stamp it out.

The problem is at its worst in fluorescent lighting equipment. The unit sale is larger than with incandescent units. The material-installation ratio is also greater. So the jobber is tempted to sell direct, especially if the contractor involved is not one of his regular customers. And the purchaser promptly swings toward the lowest price. He must be realistic. He cannot, will not and should not solve our distribution problem for us.

If any customer can call the jobber and receive exactly the same price as the contractor, the contractor cannot compete. He is forced into one of three courses of action. He can—

1. Pad the labor mark-up to cover the costs of handling the fixtures supplied by the customer.
2. Refuse to handle "labor-only" lighting jobs, or
3. Sell a competitive line of fixtures bought directly from the manufacturer at jobbers cost.

None of these alternates to realistic distribution policy are fundamentally sound. All introduce factors into the overall problem of modern lighting that should not be there. The great opportunities in postwar lighting cannot be approached effectively with a muddled and complicated price system. Each of the major elements in the distribution scheme can contribute to creative market development. And each should have appropriate compensation for his services. The lighting equipment manufacturer, the electrical wholesaler and the electrical contractor have a job ahead that can be adequately handled only by team work and crystal clear price policy.

Black lists and cooperative buying organizations run by contractors have been proposed. But why not a "white list" of wholesalers who are ready and willing to accept responsibility for sound distribution policies backed and policed by the manufacturers and loyally supported by the contractors. It is practical. It is realistic. It is plain common sense.

Washington Notes

► Manpower ranks as No. One problem of the moment as this column is written. Confusion over draft policy is a headache but could have been predicted. Deferments were never intended to provide exemption from military service but only to allow orderly replacement of young men in industry. Can war and essential needs be met under the stepped up induction program? Top WPB men believe that they can.

► Deferments for men under 26 are limited now to a few highly critical programs. If the armed forces take the 26 to 30 year old men on the same basis—and there are some predictions that this will be the next step—there will be trouble on the production front.

Some sharp criticism of manpower shortage reports has been heard. There is apparently no way that individuals can learn where the critical shortages exist excepting in their own communities. While round-up statements show the problem on a national scale, serious shortages in direct war work occur in a relatively few communities.

► Construction volume for January 1944 was $315,793,000, nine percent less than December 1943. This volume comprised four major classifications; (1) military, $78,506,000; (2) industrial expansion, $66,059,000; (3) housing, $75,000,000 and (4) all other, $96,228,000.

Expansion of government financed industrial facilities including construction, machinery and equipment totaled $165,151,000 in January of which $109,092,000 was machinery and equipment and $56,059,000 was factory construction. D.P.C. volume was $123,687,000 or 75 percent of the government financed total.

Preliminary estimates of total construction volume for 1944 add up to $3,700,000,000 or 28 percent of the 1942 volume. Cessation of hostilities with Germany in 1944 would lift the estimate somewhat.

► Only new items of civilian goods to be brought back into production this year will be articles using comparatively small quantities of material, requiring little manpower, and contributing more time and energy to war workers for their jobs. There are no early prospects for refrigeration, vacuum cleaners or radios.

► Restrictions on the use of metal in industrial incandescent lighting fixtures have been lifted. Restrictions on residential types have been relaxed.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

DISTRIBUTION TROUGH SPEEDS CABLE JOB

INDUSTRIAL

A. A. Adcock, plant superintendent of the Richmond Engineering Company, Richmond, Va. made an easy job of pulling in 8400 feet of 500,000 cir mils cable for welder distribution. With the absorption of government contracts, Richmond Engineering's welding load shot up and a much heavier distribution was needed for the three phase 440 volt circuits. Three circuits were added in the 600 foot bay and two circuits were added to the 500 foot bay. The actual time of pulling in 8400 feet was eight hours, requiring the labor of only two men.

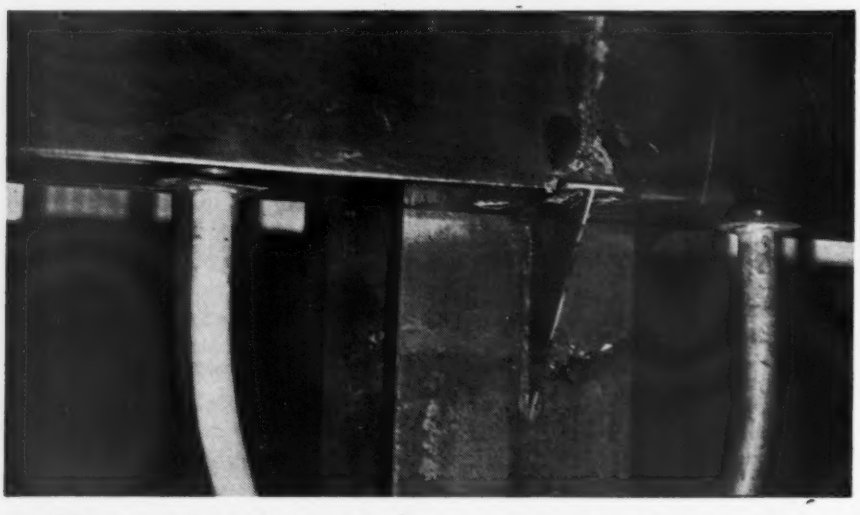
To make a quick, easy job of it, Mr. Adcock designed a distribution trough to be made up in short sections eight inches wide and ten inches deep. The cover was made ½-inch deep and slightly under eight inches wide bent to give mechanical strength. A thin-gauge steel was used in the fabrication. After each section had been formed, the cover was tack-welded to the trough. Holes were then punched to accommodate ⅜-inch stove bolts on 24-inch centers.

A crack or two with a wooden mallet would then break the tack welds, and both cover and trough were marked for identification. In this way alignment of holes was perfect, facilitating the bolting of covers into place. This gave an extremely rigid rectangular trough that could easily carry the span load without danger of buckling. Internal bracing was thus obviated, allowing cable to be thrown in rather than threaded in.

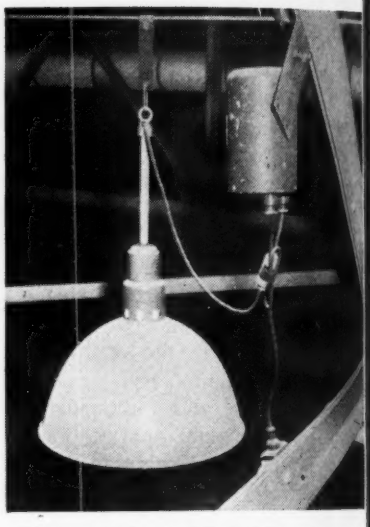
Sections were then welded end to end. Triangular brackets were welded to each building column. The trough was then set in place and welded to the brackets. Everything was now ready for pulling cable.

Fortunately, two overhead traveling cranes were located in each bay. A reel of cable was hoisted onto the catwalk of one crane and set onto a pair of horses for unreeling. Then while one man unreeled cable as his crane traveled up the bay, a second man on the following crane threw the cable into place in the trough. At the end the cable was cut and the cranes returned to the lower end for a duplicate procedure.

Nine runs in the 600 foot bay supplied three circuits and six runs in the 500 foot bay gave two circuits.



SECTIONS OF TROUGH are welded together. Triangular supports are welded to each column and trough is tack welded to support. Taps are taken off by blocking cables up from bottom, while burning hole in trough. Conduit is then put in place by use of two thin adapter plates, lock-nut and bushing



MERCURY LIGHTING units at Alcoa's New York City plant are hung from messenger wire running the entire length of the pot-line buildings. Transformers are mounted on steel plates which are bolted to building girders. Plugs and receptacles permit easy removal of either or both fixture and transformer.

To tap in for a branch run to a new welder, the cover is removed from the proper section, the cables are blocked up out of the way, a hole is burned through the bottom of the trough and conduit is then set into place by the use of two adapter plates, a locknut and bushing.

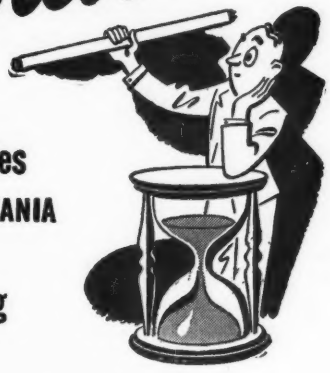
CORRODED WELDER TUBES EASILY MAINTAINED

MAINTENANCE

Even equipment which is practically maintenance - free under peacetime operating conditions may now require some maintenance precaution to meet an emergency situation, which is strictly a wartime problem.

Such is the case with the Allis-Chalmers Weld-O-Tron arc welder. Hundreds of operators who are successfully welding many kinds of thin metals in aircraft, shipbuilding and scores of other industries reported no mainte-

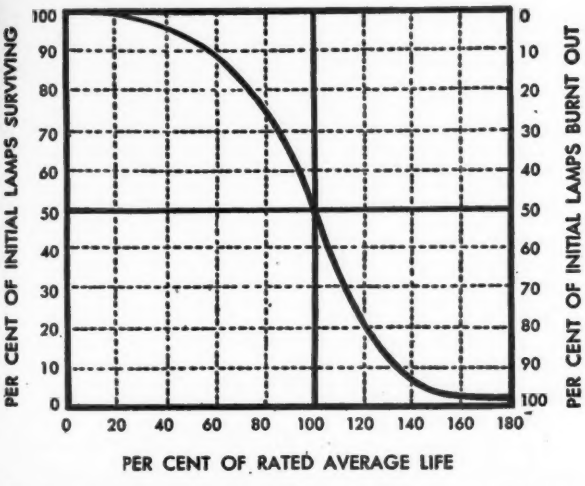
Fluorescent operating hints



No. 2 of a series published by SYLVANIA for all users of fluorescent lighting

HOW TO GET FULL LAMP LIFE

Average rated life of good-quality fluorescent lamps is 2500 hours for the 40-watt size — 3000 hours for the 100-watt size. But the life of individual lamps may vary as the chart shows:



And actual operating conditions seldom are as favorable as controlled laboratory tests. Nevertheless, these average rated life figures will help you estimate how many lamps you will normally replace every month. Simply use 2500 or 3000 hours as indicated in this formula:

$$\text{Expected lamp renewals per month} = \frac{\text{No. of lamps} \times \text{average burning hours per month}}{\text{Rated average life of lamps in hours}}$$

If your actual monthly replacements consistently exceed the calculated figure in your own formula, it will pay you to check these five factors, which shorten lamp life:

1. TOO FREQUENT STARTING: Average rated life is based on lamps operating for not less than four hours every time they are started. More frequent starting dissipates the filament coating vital to fluorescent performance — and thus shortens lamp life.

2. DEFECTIVE STARTERS: Starters that are not working properly may cause the lamp to blink off and on, a condition that also shortens lamp life. Sylvania Starters cost only a few cents and should be replaced as necessary to protect your lamp investment.

3. VOLTAGE VARIATIONS: Fluorescent lamps are made to operate within specified *ranges* of voltage — for example, 110-125 volts. Variations within the specified voltage range do not seriously affect a lamp. But at voltages much below the range, starting becomes uncertain, and there is an excessive drain on electrode material — with a resultant toll on lamp life. Above the normal range, there is also a life-shortening effect. In addition, light output also is affected by voltages outside the normal range.

4. LOW TEMPERATURE: Fluorescent lamps are designed to operate most efficiently between 60 and 90 degrees Fahrenheit. If low temperatures are unavoidable, lamps may be protected with enclosed fixtures.

5. EXCESSIVE VIBRATION: This reduces lamp life and can often be prevented or minimized.

For Additional Maintenance Information

Send for this Free Booklet

100,000 already distributed

SYLVANIA ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

RECTIFIER TUBE bases which are no longer nickel-plated can be easily maintained by removing corrosion with steel wool or emery cloth.

nance problems, until a metal shortage forced a minor change in manufacturing. Now that rectifier tubes used in this unit are no longer being nickel-plated, new tubes have a tendency to corrode at their bases.

But the solution is easy. Good contact can be maintained if the bases are brushed about every six months with a small piece of steel wool or emery cloth.

SIX THINGS TO REMEMBER WHEN USING SOLDER

INDUSTRIAL

Today's solder decidedly differs from pre-war solder, and so should soldering technique. Previously, solder was composed of tin and lead in about 50-50 ratio; today, except for certain applications, solder contains not more than 20 percent tin, with perhaps small amounts of silver, bismuth, antimony or tin. Today's soldering technique calls for a hotter soldering iron, and attention to certain details.

1. Keep your work clean. Guard carefully against varnish, grease, oil, dirt, rust, or corrosion products. They prevent the flux from acting and the solder from alloying with the parent metal.

2. Keep in mind that the purpose of the soldering iron or torch is not to melt the solder but to heat the work until the solder will flow when applied to the work.

3. Keep the soldering iron clean and, to have the quickest possible heat transfer from the iron to the work, have the tip designed actually to fit against the work.

4. Investigate different methods available for doing the work—hotter electric iron, high frequency, or carbon resistance soldering tools may do the job better.

5. Design your joints to have 0.003 to 0.005 in. solder thickness, and so that the two parts overlap. Lap or seam-type joints are better than butt-type joints. Have the solder fill the seam completely. Heavy fillets add little strength to the joint, and waste solder.

6. Don't hand a new solder, a flux, and a soldering job to a workman and expect a perfect job the first time. Let him get the "feel" of the new material. Don't give up a new solder after one unsuccessful trial—the chances are your technique is not what it should be for that particular solder.

These soldering suggestions come from the metallurgy committee of the General Electric Co.

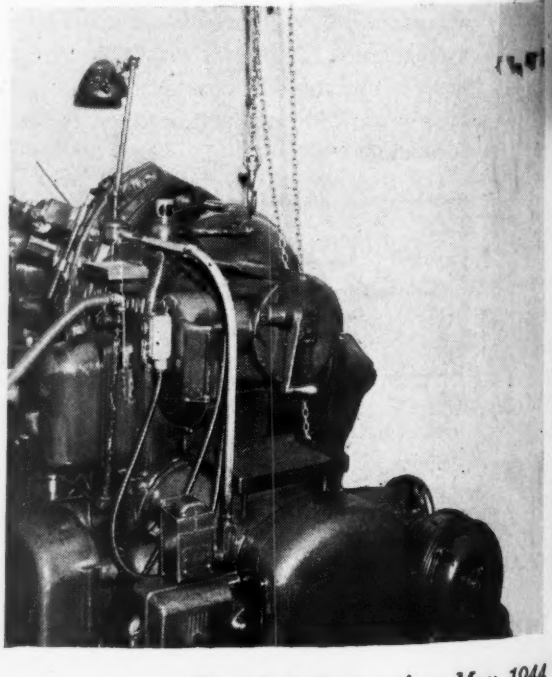
POWER FED MACHINE LIGHTS

WIRING

In order to secure the best possible lighting at the actual work area, the Tool Steel Gear and Pinion Company, Cincinnati, Ohio supplements its fluorescent general lighting system with incandescent local lighting units mounted to the individual machines. Normally such units would be fed from the general lighting system, involving masses of conduit, wire, drop cords and the enormous amount of trouble shooting such a system might incur.

To avoid all of this, the local lighting units, generally of 50-watt size, are individually fed from the power circuit serving the machine. The shift from the 220-volt, 3-phase power to the 110-volt, single-phase lighting circuit is made through individual .075 kva. transformers mounted directly above and connected to the line side of the motor starter. In the more modern starters, where the enclosures provide more working space, 3-phase fuse blocks are installed to protect the transformer and to prevent the use of these local lighting outlets for electric drills.

Maintenance time on local lighting systems of this type is materially reduced. If a unit should go out, the trouble is immediately localized to that particular unit on that particular machine and no other units are affected. There is no need for checking over involved circuits to locate the fault.

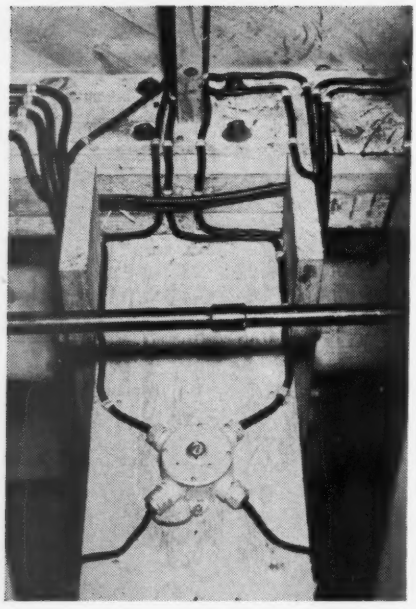


LOCAL LIGHTS on machine tools are fed by a small individual transformer connected to the power circuit serving the machine. Scheme saves critical materials and reduces maintenance chores.

GROUNDING OUTLETS IN NON-METALLIC SYSTEM

WIRING

When the Oak Ordnance Plant was constructed in Illinois some time ago, conduit was more scarce than the proverbial hen's teeth. However, the armed forces were clamoring for ammunition so the plant had to be completed in the quickest possible time. Engineers on the job decided to use what materials were at hand to get the plant in operation. Hence the interior distribution system was installed in non-metallic sheathed cable. Dust-tight and explosion-proof outlets were installed wherever there was danger of electric arcs or flashes. (Although not a conventional explosion-proof installation, it was designed as an emergency "duration" expedient under the supervision of competent engineers, deemed

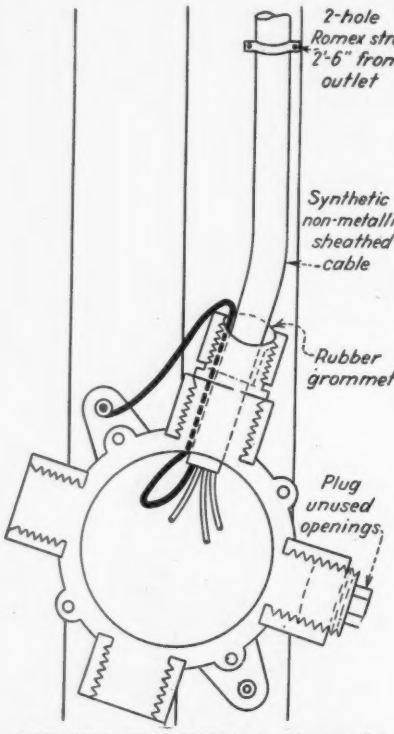


JUNCTION BOX feeds two circuits of lighting units on opposite sides of a concrete partition in area where smokeless powder shells are filled. Note how box is grounded to fourth wire of the non-metallic sheathed cable.

safe for the powder dust hazard that existed, and is operated under a most rigorous maintenance program.)

Since the buildings are of wood and asbestos siding construction, the problem of adequately grounding the metallic explosion-proof and vapor-tight outlet and junction boxes arose. In the case of the power circuits, four-wire non-metallic sheathed cable is used with the fourth insulated wire serving as a grounding conductor. The same scheme was used on the lighting circuits to provide a continuous ground between outlets. These in turn were tied in with a ground network in the floors of the buildings.

The problem of making a dust-tight installation where the non-metallic sheathed cables entered outlets was solved by using specially designed rubber grommets in the outlet hubs (see detail sketch). Where switching devices were encountered, conventional explosion-proof sealing fittings with ordinary cable clamps were installed.



RUBBER GROMMETS incorporated in threaded hubs of fittings make a dust tight fit where non-metallic sheathed cable enters outlet. Ground conductor is carried back through grommet and fastened under outlet mounting screw.

KNOWLEDGE OF CIRCUITS AIDS TROUBLE-SHOOTING D-C CONTROL—NO. 2

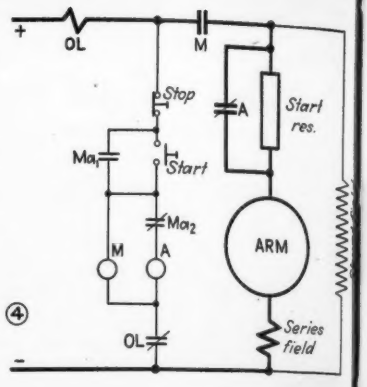
BY L. E. MARKLE*

CONTROL

Fig. 4 is similar to Fig. 2 except the neutralizing winding has been omitted on contactor A. The accelerating contactor A is of the magnetic-flux-decay type. It is spring closed, has a single-winding coil, and a high-grade magnetic circuit. A shim of non-magnetic material is included in the magnetic circuit to reduce the effect of permanent magnetism. Thus, the contactor armature will *not* be held closed indefinitely. The rate of decay of flux depends on the amount of copper used in a damper winding. Therefore the maximum time obtained depends upon the number of copper rings used in the damper winding inside the coil. By adjusting the spring pressure, the operating time of the contactor can be changed over a certain range depending on the number of copper rings used.

Fig. 5 shows one way to obtain dynamic braking. Control circuits have been omitted, but they are duplicate of those in Fig. 2. Line contactor M has two poles, one normally open and the other normally closed. Both poles are equipped with an operating coil and are on the same armature, which is hinged between the contacts; that is, they are mechanically interlocked.

In starting, when M closes, MA opens. Then when the STOP button is pressed, M drops out and MA closes. Coil MA is energized by the counter-emf of the motor armature when the motor is running. It cannot close contacts MA while coil M is energized. The motor, now acting as a generator,

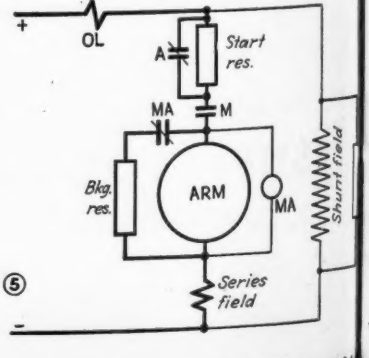


is connected to the braking resisto through closed contact MA. Contac MA is sealed in tightly, establishin good contact pressure until the moto comes to rest.

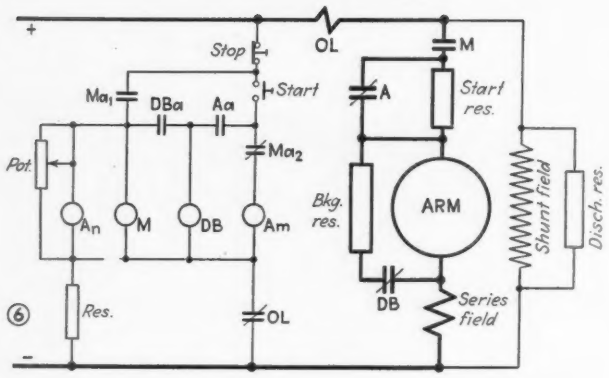
Fig. 6 represents the use of a sepa rate spring-closed contactor for dy namic braking. Pressing the START button energizes coil Am which open contact A, closes contact Aa whic energizes coil DB, which in turn open contact DB and closes contact DBa When DBa closes, coil M become energized, line contact M closes, Ma closes establishing a holding circui Ma_2 opens de-energizing coil Am, an An starts timing. At the preset instan the contactor armature of A drops ou closing contact A shorting-out th starting resistor and the motor come up to full speed.

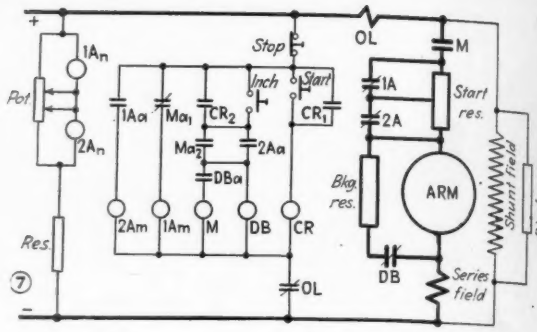
Pressing the STOP button de-ener gizes both coils M and DB, contact M opens at the same instant that contac DB closes, and dynamic braking is ap plied to the rotating armature.

The arrangement in Fig. 7 is used t secure a quicker response of motor fo more accurate inching. Note that whe the line disconnecting switch is close coil 1Am is energized immediatel without the pushing of any START o INCH buttons. Thus 1A opens, 1Aa closes energizing 2Am which opens 2 and closes auxilliary contact 2Aa. Now when the INCH button is pressed con tactor DB picks up immediately, open ing DB, closing DBa and then con tactor M picks-up, closing line con tactor M and the motor starts. In thi manner there is no delay after th INCH button is pressed since con



** Control Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.*





tactors 1A and 2A are already energized and open.

For a regular start, 1A and 2A are open, and pressing the START button first energizes coil CR closing CR_1 which establishes the holding circuit and also closing CR_2. Since 2Aa is already closed (coil 2Am being already energized) contactor DB picks-up, opening contact DB, closing DBa which energizes coil M and closes line contact M, closes auxilliary holding-contact Ma_2 and opens contact Ma_1. Opening Ma_1 de-energizes 1Am de-starts 1An timing. After the preset interval, 1A closes, 1Aa opens, 2Am de-energizes, 2An times, and after the proper interval closes contact 2A. The motor then runs at full speed.

Pressing the stop button, de-energizes CR, opens CR_2 which de-energizes M and DB; line contact M opens, DB closes and dynamic braking is applied to the motor armature.

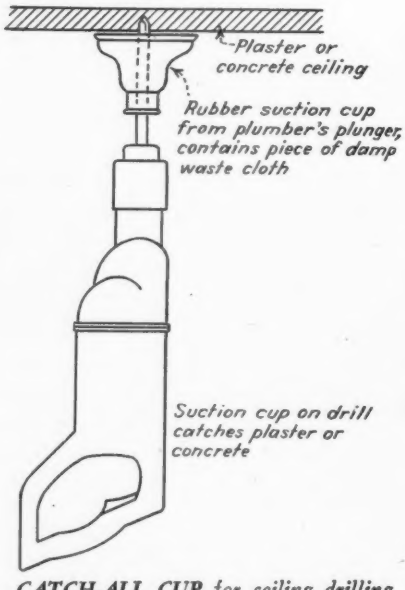
CAPPED DRILLS CATCH DIRT

WIRING

That well known household accessory and "plumber's helper"—the rubber suction cup used to disgorge clogged drains—has been turned into an "electrician's helper" by A. C. Loyd of Loyd Electric Company, San Antonio, Texas.

Mr. Loyd removed the handle, punched a hole in the neck of the cup and placed it over the shaft of star drills and other drills used on concrete or plaster ceiling work. When using it, the electrician holds the cup and drill in his left hand and the hammer or electric drill, whichever the case may be, in his right hand. The cup, when equipped with a bit of dampened waste cloth and held close to the ceiling, will catch all dust and drillings that formerly dropped to the floor.

This little "gadget" is now standard equipment for all Loyd electricians. It has proved to be a considerable time saver on jobs where a coating of pulverized plaster or concrete on rugs, desks and machinery is highly undesirable—in offices, food plants, areas where precision machine tools and equipment are used, and similar applications. And the psychological effect on the customer who sees the electrician take this precaution is a reward in itself.



***CATCH-ALL CUP** for ceiling drilling applications prevents coating of pulverized plaster or concrete on equipment below. A rubber drain suction cup with a hole punched in the neck and a bit of dampened waste cloth does the trick.*

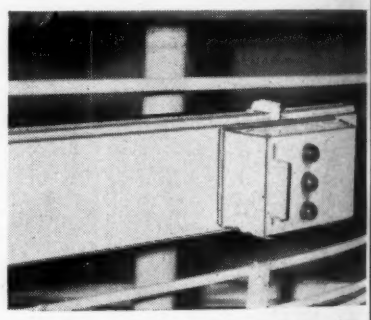
PLUG-IN GROUND DETECTOR

INDUSTRIAL

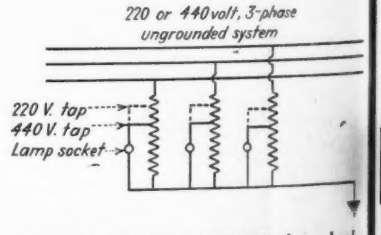
Ground detection is one method of determining grounded conditions on power systems before any appreciable damage can occur. With this in mind, the Tool Steel Gear and Pinion Company of Cincinnati equipped Flex-A-Power circuits in its plant with plug-in type detectors.

Termed neutralized Flex-A-Plugs by the manufacturer, these units enclose suitable resistors connected to ground to provide a discharge method for transient voltages which may build up on the secondary system. Taps from the resistors are extended to three sockets accommodating neon glow lamps in the enclosure cover. The ungrounded side of each resistor is connected to one phase of the ungrounded power system. Such detector plugs are generally mounted to the end of the duct run.

Under normal operation, with no ground on the system, all three lamps



***VISUAL WARNING** of a grounded feeder is given by this detector plugged in at the end of a feeder duct. All lamps glow under normal operation. If one goes out, there is a ground on that particular phase.*



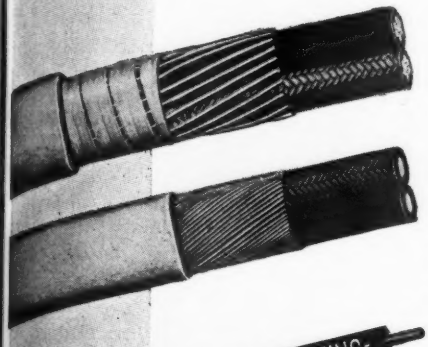
***SCHEMATIC DIAGRAM** shows hook-up for ground detector lamps and neutralizer resistors in the unit illustrated above.*

glow with an equal intensity. If one lamp should go out, it indicates the presence of a ground on that particular phase of the system. This may be on the duct run itself or on any piece of equipment connected to the run. Once a ground condition is detected, it is merely a question of running it down and correcting it. Operators in the vicinity of the detector can be cautioned to occasionally glance at the unit and report if one of the lamps is out.

HAZARD CABLES

to fill many needs...

The wide range of cables made by Hazard provide for many problems met in the course of the day's work. Here are examples, designed for specific requirements and built to withstand a number of severe conditions. Hazard research and experience are at your command to help in choosing the right cable for the right job.



HAZARD SERVICE CABLES FOR SERVICE DROPS AND ENTRANCES

Type SE (ABN and UBN) cables, with synthetic rubber insulation, prevent current diversion, eliminate conduit and extra fittings and are architecturally harmonious. Type SD is efficiently designed for service drops. Sizes 12 to 2 inclusive, 2 and 3 conductors.

HAZARD PERFORMITE TYPE RH BUILDING WIRE IS SUPER AGING

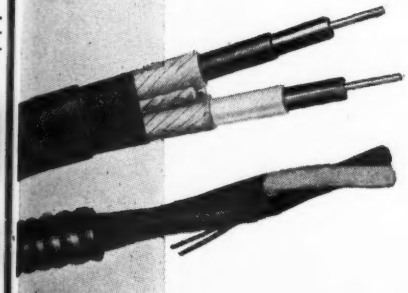
This heat-resistant long-life wire is free stripping and easily installed. Because of its greater carrying capacity, it saves strategic copper. Recommended for branch feeders and general light and interior wiring. All sizes available.

TYPE R HAZACODE WIRE

exceeds all minimum requirements of N.E. Code and is recommended for general interior building wiring; has a sturdy, long lived, flameproof braid covering, and is readily installed.

TYPE RL HAZACODE LEAD ENCASED

is particularly useful now for damp locations while Type RW is unavailable.



HAZARDEX NON-METALLIC SHEATHED CABLE AND HAZARD ARMORED CABLE

for interior wiring are both obtainable. These familiar types of cable are made to exacting Hazard quality standards.

TYPE K FABRIC COVERED CORD—an approved cord for ordinary use.
TYPE KK HAZARD SPIRALWEAVE CORD a portable cable for heavy duty.

Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

ELECTRICAL WIRES AND CABLES

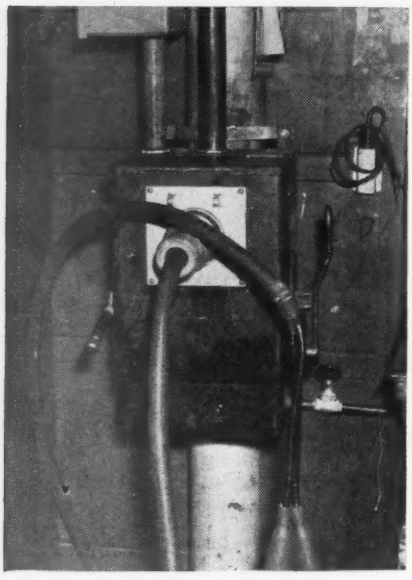
ARMY E NAVY

3641

MOTOR SHOPS

REMOTE TEST STATIONS

One morning Joe Ferrari of Excel Electric Service, Inc., Chicago motor repair specialists, walked into his shop and saw a line of motors in front of the test board with his men eagerly awaiting their turn at the board. Well, this condition must be remedied if Excel was to get out on schedule the motors which war plants badly needed.



***REVAMPED COMPENSATOR** provides double voltage test facilities for 110 volt and 220 volt motors, relieving main test board of congestion. Lever on left is a mechanical "position" lock for operating handle on right.*

And remedy it, he did. With his brother Ben, he corralled two scrapped, old style compensators, removed the coils and revamped the interior with two sets of contacts that would act as an oil immersed double-throw switch. The no-voltage release trip was revamped into a mechanical trip which now locks the operating handle into one of three positions—forward, "220 volts," center, "off," and back, "110 volts." The trip lever is on the opposite side of the case from the operating handle.

Mounted flush with the face of the case is a 3-prong Russell & Stoll, 90 ampere (220 volt) receptacle complete with plug and test leads terminating in rubber booted test clips.

Two of these remote test stations are now spotted on shop columns where space permits testing activities. They are connected to the secondary of a 20 kva., dry type, 110/220 volt transformer.

These stations are used for testing 110-volt and 220-volt equipment and starting heavy 220-volt motors. The main test board is now relieved of considerable congestion and free for 440-volt and high voltage testing purposes as well as normal amount of 110-volt and 220-volt testing.

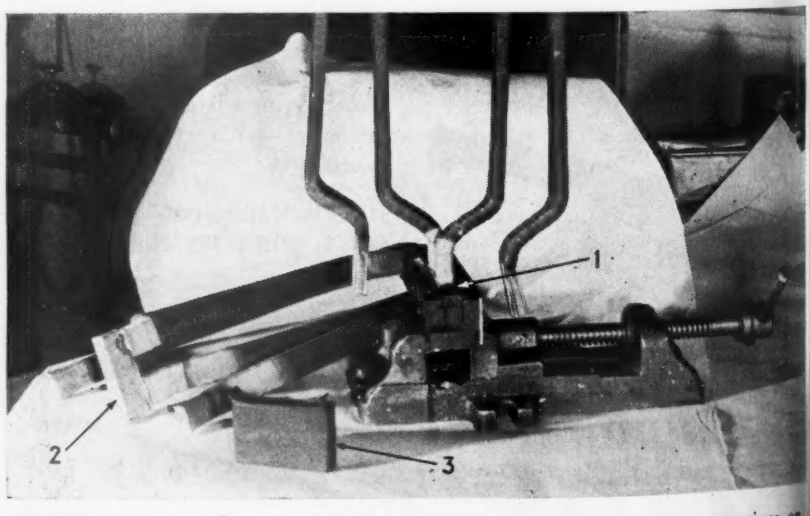
COIL ENDS SOLDERED IN MOLD

When the Scherer Electric Company, Indianapolis motor service organization, was called in to rewind a 700 kw., 220-volt, 3-phase alternator, they made it a combination shop and field job—making the coils in the shop and installing them in the field. To reduce the field work to a minimum, they decided to make as many coil connections in the shop as possible. The first step was to make a detailed diagram of all connections, numbering each coil and each connection so there would be no slip-up when the field installation was made.

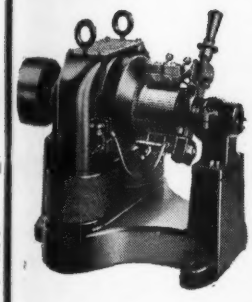
The shop work consisted of making the coils together with all stub connections and connections for one side of the pole. Since there was a total of 244 double joint connections to be made, Scherer decided to set up a quick, simple and efficient method of soldering these joints. Hence a special mold of $\frac{5}{8}$-inch sheet carbon was made and mounted to the jaws of a drill press vise.

Each coil consists of ten turns of $\frac{1}{16}$-inch by $\frac{1}{2}$-inch flat copper strip (five turns per built-up conductor, two conductors per coil). Connections were made after the coils were insulated, dripped and baked. Each double joint was made with a double clip with a copper spacer between coil ends. Once the clips and spacers were attached, the joint was placed in the mold, the vise jaws tightened sufficiently to hold the coil upright and the soldering begun. The flame of an oxy-acetylene torch supplied the heat to melt the strip solder which flowed evenly in and around the clip. After the solder cooled, the coil was removed and the joint needed no additional filing or dressing. The mold prevented the solder from running out of the clip and produced a smooth well-filled connection.

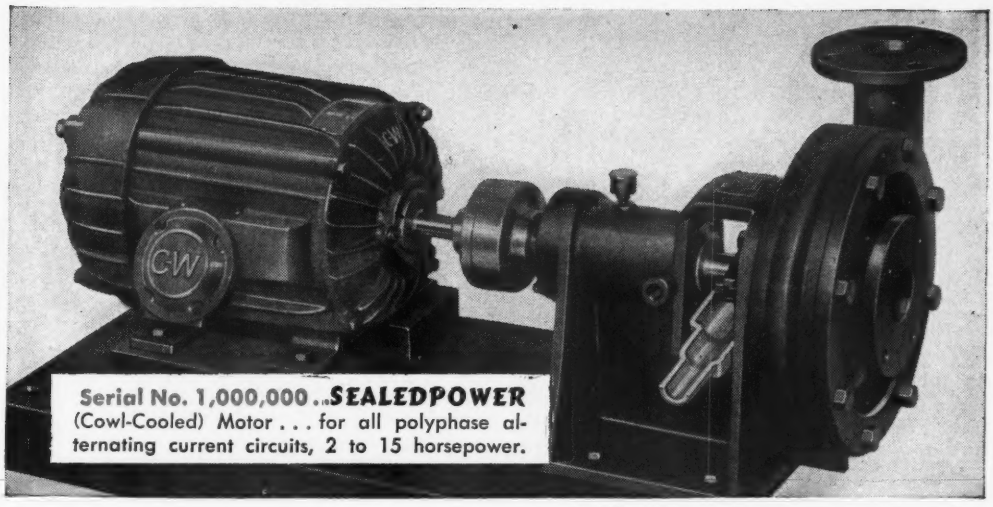
Next came the problem of insulating these double connections. Hand taping would have been difficult and time consuming. The solution lay in the development of an insulating "boot" which slips over the soldered joint. Each "boot", consisting of a cell made of $\frac{1}{32}$-inch pressed board and wrapped with three layers of 0.015-in. by 2-in. stay binding, was impregnated with insulating varnish and baked.



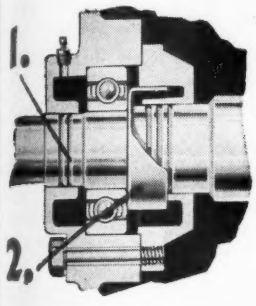
***CARBON MOLD** mounted on vise jaws speeds soldering of double connections on these alternator coils. Solder is fed into mold (1) completely filling and flowing evenly around clip to provide a smooth joint (2) that needs no additional filing or dressing. Insulating "boot" (3) is then slipped over joint and taped in place.*



Serial No. 1 . . . Crocker-Wheeler Motor, built in 1888.



Serial No. 1,000,000 . . . **SEALEDPOWER** (Cowl-Cooled) Motor . . . for all polyphase alternating current circuits, 2 to 15 horsepower.



1.
2.

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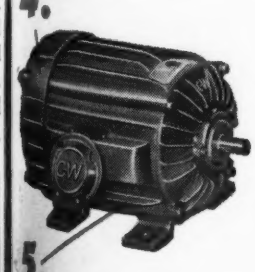


4.
5.

SEALEDPOWER

Industry's Most Trouble-Free Motor

PRODUCED BY CROCKER-WHEELER'S 56 YEARS OF EXPERIENCE

CROCKER-WHEELER FEATURES:

1. Patented "Groovseal"—no greasing needed for at least a year. Grooves minimize grease loss. This seal makes bearing maintenance expense negligible. It permits use of softer grease, for better lubrication and longer bearing life. Airtight seal prevents dust or other foreign matter from entering bearings.

2. Crocker-Wheeler's exclusive De-Sludging Impeller. Automatically desludges . . . churns and distributes grease to bearings when motor is started.

3. Vacuum Impregnation—standard on *all* Crocker-Wheeler motors. Seals out foreign matter and moisture from each individual coil . . . fills all interstices, making windings a homogeneous mass . . . reduces hot-spot temperature and lengthens insulation life. Adherence of varnish prevents vibration of wires either inside or outside of slot. (Photograph shows cross sections of baseballs, (left) after vacuum impregnation and (right) before vacuum impregnation. Note penetration of varnish to center of tightly-wound ball, making it a moisture-proof, homogeneous mass.)

SEALEDPOWER FEATURES:

4. Totally Enclosed Cowl-Cooled Construction resists corrosion. Protects against acid or alkali fumes, splashing or dripping liquids, air-borne moisture, steam, corrosive gases, conducting dusts, metallic chips, etc.

5. Fin Type Construction for non-clog ventilation and easy cleaning.

WRITE FOR LITERATURE ON THE **SEALEDPOWER** MOTOR, WHICH IS WINNING THE PREFERENCE OF MACHINERY MANUFACTURERS AS WELL AS OF MOTOR USERS. OR CALL OUR NEAREST OFFICE.

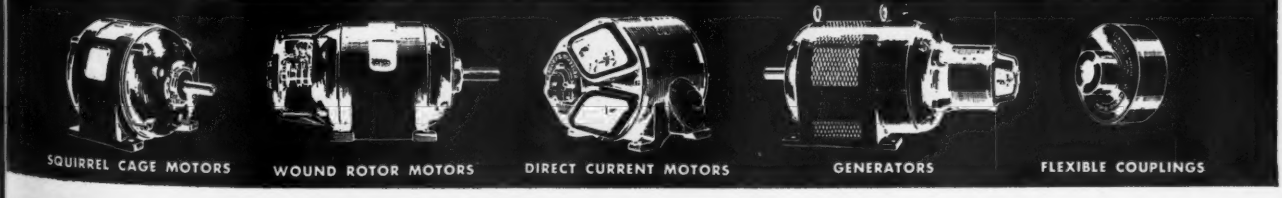
JOSHUA HENDY IRON WORKS

CROCKER-WHEELER DIVISION

ESTABLISHED 1856

AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON • LOS ANGELES



SQUIRREL CAGE MOTORS | WOUND ROTOR MOTORS | DIRECT CURRENT MOTORS | GENERATORS | FLEXIBLE COUPLINGS

The "boot" is then slipped over the joint and taped in place. A small block of wood, placed in back of the clip and between the coils as a spacer, provides the bearing surface for the main binding.

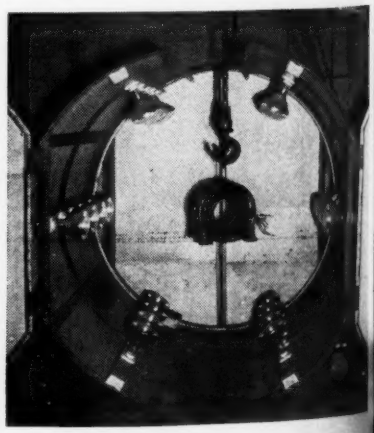
The net result is a well soldered, well insulated joint that has a streamlined, sleek appearance. In addition, the management estimates that this method of making the coil connections saved them approximately 30 percent in labor—an important consideration when equipment is out of service and waiting for repairs.

SIMPLIFIED INFRA-RED OVEN

When Wm. Keck & Sons recently took over new headquarters for their motor repair business in Joliet, Ill., they decided to use infra-red heat to bake their repair jobs. So they set about building an oven that would handle the work they encounter.

The oven is a simple cylindrical structure consisting of an angle and flat iron skeleton with a sheet steel skin. Constructed to accommodate motors up to 60 hp. in size, the enclosure is 54 inches in diameter and 51 inches long. Steel supports resting on the floor cradle the oven, which is located in direct line with and a few feet away from a dip tank pit in the shop floor. The back of the oven is enclosed with sheet steel and the front is equipped with sheet steel, hinged, double doors. Access for a hoist chain and hook is provided by an opening running the full length of the top of the oven.

Six rows of 250-watt reflector type infra-red lamps provide the heat source. The lamps nest in porcelain sockets mounted on 7-inch centers on conventional Curtis window stripping, so



***CIRCULAR OVEN** equipped with six rows of infra-red reflector type lamps, handles motor baking operations in this shop. Openings at side of door supports and top of oven provide air circulation for removal of generated fumes.*

TOOLS TO BUILD THE WORLD OF TOMORROW

. . . . born from the need of today

Born of a need to conserve critical aluminum, Thor "Armored-In-Plastic" portable electric drills today are smashing quotas on the jobs for which they were created!

Developed with features that provide light weight, easy handling, toughness and durability . . . these remarkable tools bring to vital industries unsurpassed production performance.

Thor "Armored-In-Plastic" portable electric tools already have a solid background of experience that will enable them to fashion—*more rapidly and more lastingly*—the emerging "World of Tomorrow."

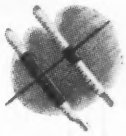
AND...WHAT ABOUT "THE TOOLS OF TOMORROW?"

Thor has more new and revolutionary portable electric tools in its experimental laboratories today than at any time in its fifty years of pacing the field with new developments. For a brief glimpse of the trend, ask for your copy of Thor's remarkable new booklet, "Tools to Build the World of Tomorrow...Born from the Need of Today."

JOB-PROVEN FEATURES OF *Thor* "Armored-In-Plastic" ELECTRIC TOOLS

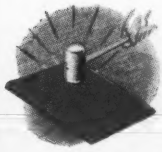
Extreme lightness of weight—Application of "Thorite" plastic in gear case, field case and handle housings provides 14% lighter weight—without sacrifice of maximum power and other essential properties.

Exceptionally high impact strength—Tests by approved laboratory methods show "Thorite" plastic tool housings to have impact strength greater than aluminum.. assuring high resistance to shock blows.



Remarkably low thermal conductivity—"Thorite" is a non-conductive plastic that prevents heat developed by the motor from being transmitted to the hand of the operator . . . providing *constant* cool handling.

Increased safety factors—"Thorite" plastic housings, so efficient as non-conductors, offer *extra* safety against electrical shock.



Toughness and durability—Strength characteristics of "Thorite" plastic, as shown under approved testing methods, compare favorably with aluminum.

(Tensile strength — 8,000 pounds per square inch; Flexural strength — 13,000 pounds per square inch; Compressive strength — 23,000 pounds per square inch.

Thor Portable Electric Tools

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO, ILL.

Branches in Principal Cities

mounted that the heat from all lamps will be evenly projected around the work in the oven. The individual strips are fed by a conduit line near the rear of the enclosure and the lamps are controlled by a time clock mounted on a nearby wall.

At present, only five lamps are used in each strip. Provision is made, through the installation of a convenience outlet in one of the strips, for future addition of either portable or door mounted units on front and rear to produce a complete sphere of heat and eliminate the necessity of revolving the work to assure all around, even, baking.

THRUST PLATE FOR COMMUTATOR SOLDERING

Soldering armature leads into commutator bars requires holding the armature at an angle to keep the solder from running down among the leads in back of the commutator. This operation is facilitated by a simple thrust device used in the motor repair shop of Electrical Equipment Company, Richmond, Va.

An ordinary clamp-type lathe dog is tightened to the shaft (back end) to keep the rope sling from slipping off. By use of chain-falls any resired angle can be obtained.

The commutator end of the shaft is then allowed to rest in a simple thrust

A SHORT PIECE of angle iron is used as a thrust device while tipping armature for soldering leads into commutator bars. The piece is lined with thin strips of fiber to protect shaft-end and two larger blocks of fiber bolted to each end holds shaft from slipping sideways.

device which is a short piece of two-inch angle iron six inches long and padded with fiber blocks to protect the shaft end. In addition to a thin lining of fiber completely covering the inside of the angle piece, two 2-inch blocks of fiber are bolted to each end to keep the shaft from slipping out of the device.

ALL OVER THE MAP...

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More than ever before, service to customers is vital. Sound representation, strategically located, is an important factor in attaining this end. Fifteen nationwide branches of Federal, staffed by men who know your needs and are skilled in the knowledge of what our products can do for you, are at your call.

If you have any electrical problems involving safety switches, panel boards, switchboards or circuit breakers, please call upon the nearest Federal office for suggestions, without obligation.

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SAFETY SWITCHES · PANELBOARDS · SWITCHBOARDS · CIRCUIT BREAKERS

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

QUESTIONS ON THE CODE

A GROUNDING PROBLEM

Q. *"Wherever overhead wires are brought from the building containing the main entrance to another smaller building a hundred or two hundred yards away, which of the following methods is proper to ground the BX in the smaller building, or are both 'O.K.'?*

"By connecting a short length of wire between the grounded or neutral wire and the screw on the weather cap, on both ends of the overhead wires, or

"By running a ground wire to a driven ground in the other or smaller building.

"Where does it refer to the above in the Code?"—E.A.K.

A. Section 2524 of the Code permits the grounding of the neutral of the wiring system in any building of a group of buildings served by a master service as near as practicable to the entrance of the conductors to the building. If a water pipe ground is not available a driven ground may be used.

Section 2523, however, prohibits the grounding of the armor of the armored cable in this smaller building to the grounded neutral. Therefore, the weather caps on the outside standpipes should not be connected to the neutral.

SNAP SWITCH

Q. *"Enclosed please find a sketch showing a toggle switch supported on a metal plate with contacts and body of the switch covered with a metal housing.*

"From reading the code on spacings for live parts of switches from metal surrounding the switch, my interpretation is that in cases where insulation is used on the metal housing that the spacings can be greatly reduced.

"Is it according to code to make the housing, lined with insulation, a size that will just nicely fit over the switch even though a live contact terminal on the switch touches the insulation?

"Space at one or both ends of the housing can be provided in the housing in question to allow a fitting to be attached through a knockout in the housing."—B.A.S.

A. It is assumed that this is a snap switch enclosed in a metal housing and that this switch with its housing will be installed in a regular switch or wall box. This housing therefore does not constitute the outlet box but is in addition thereto. This being the case there are no definite limitations as to the spacings. Naturally, if the housing is unlined there must be a space of ½ inch between the heads of the screws and the back of the housing; but with the fiber lining this does not hold.

There must be room for the wires and care must be exercised that the wires are not pressed against sharp edges of holes through which they pass or against sharp edges of the switch.

If, however, this housing did constitute the outlet box then definite spacings would be required. For instance, to satisfy section 3705 (paragraph b), there would have to be two cubic inches of free space not occupied by the switch for each No. 14 wire used in the box and there would have to be ½ inch space between live parts and the box. Also the box would have to be of No. 14 gauge metal.

***WIRING STANDARDS** can be maintained if contractors will "sell up" and not unsell jobs, says W. B. Stewart, chief electrical inspector, City of San Antonio, Texas. A lot of bad jobs can still be corrected, he told members of NECA's South Texas Chapter.*

FUELING PITS

STATEMENT . . At an airport there are plane fueling pits located about 100 to 200 feet apart. The fueling pit boxes are of steel sunk in the ground (filled in ground) with their tops a few inches above grade. In about the center of each pit box is a pull box into and from which are run 3-in. conduits, extending about three feet beyond each side of the box. Between the end of the conduit of one box and that of the next is fiber conduits encased in concrete. The junction between the fiber duct and the rigid conduit is made by means of approved couplings. From the above pull box (which is an approved explosion-proof junction box) a piece of rigid conduit runs to an explosion-proof switch and then to an explosion-proof light. The switch box is provided with integral sealing chambers, and the pull box is filled with a sealing compound to prevent the entrance of water. Each pit box is 4 feet deep, by 3 feet wide by 9 feet long. No other electrical equipment is contained in the pit.

Q. *"Are sealing fittings required where the conduit enters or leaves the pit?"*—M.E.R.

A. The only place where arcing is likely to occur is in the switch

box and as this has integral sealing spaces for sealing off this box from the conduit system no sealing off fitting would be required in the conduit entering or leaving this switch box.

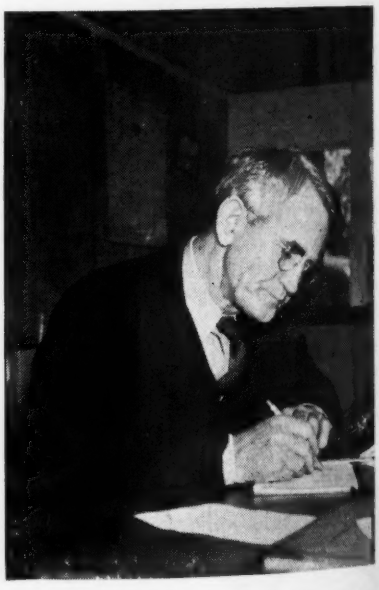
As the pull box is entirely filled with sealing compound to prevent the entrance of water there would be no further safety added by installing sealing fittings in the conduit where entering or leaving the pit box. There would be only a few inches or a couple of feet of this conduit anyway so nothing would be gained.

Also no arcing or sparking would be likely to occur in the 100 to 200 feet of fiber duct between pits nor could any gasoline fumes be carried past the pull box in the adjoining pit.

SN WIRE

Q. *"I understand that the wire manufacturers are no longer permitted to make RW wire which we have been using for underground work which is the reason why we cannot buy it any more at the supply stores. The supply people are now trying to sell us some synthetic insulated wires, type SN, for underground use. Will that be approved?"*—J.A.

A. The Code does not recognize SN wire as suitable for use in damp or moist locations such as underground work, and reports have come in showing failures of this type of insulation on underground work. It seems to be about on an equal with



AN ENGINEER to the nth degree is A. C. Loyd, Loyd Electric Co., San Antonio, Texas. One of his many projects (resulting from a hobby of designing things) is the electrification of old type, rope operated, hand elevators—a profitable business for both himself and the customer.

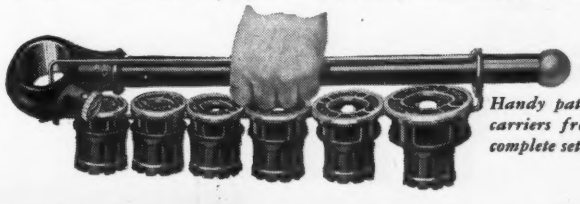
RIGID HOUSING *doesn't break*

Handy little THREADER that's a big *work-saver* RIGID NO. OOR

So... no repairs—no repair expense—no wrenches out of use

● When you use RIGIDs, you don't need so many spares around—for these wrenches usually last till you lose them. Ask any of the millions who use them. They'll tell you also that the full-floating hookjaw and the adjusting nut *always* work freely, never bind. The no-slip jaws, handy pipe scale on hookjaw and comfort-grip I-beam handle are also things you'll like. For economy and easier work, buy the RIGID—at your Supply House.

● Its popularity comes from more than its popular price. For this small RIGID Ratchet Threader, ⅛" to 1" pipe capacity, has many time-and-work saving features you like—heads that snap in from either side and lock; dies that reverse quickly for close-to-wall threading. Dies are of tool steel, accurately ground, easily removed for regrinding. Special conduit dies, if you want them. It pays to ask for No. 00Rs—also 111R, ⅛" to 1¼" at your Supply House.



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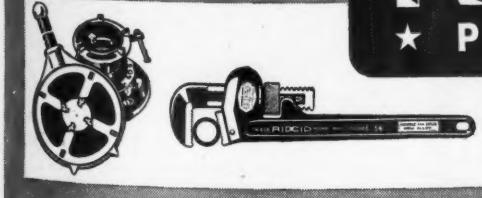
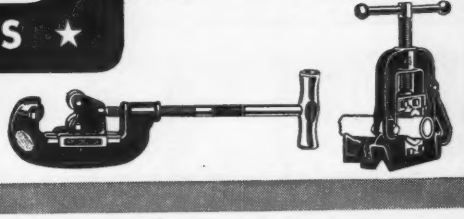
Millions of RIGID Tools in use





THE RIDGE TOOL COMPANY
Elyria, Ohio, U. S. A.

EDW. A. SCHOTTS JR., Schotts Electric Co., Fort Worth, Texas, heads one of the oldest electrical contracting firms in the Lone Star State. With his crew busy on industrial work, Ed has taken over the appliance repairs himself.

Type R insulation as far as moisture goes, but is far superior to Type R where oil or gasoline is encountered.

There is now a new type of synthetic insulation known as SNW being made and listed by Underwriters' Laboratories for use in wet locations. We understand that several manufacturers are now making this but do not know the availability of it on the market. This type will however replace the old lead covered rubber insulated wires in wet or moist locations.

OFFICIAL INTERPRETATIONS

by the

Electrical Committee of the N.F.P.A.

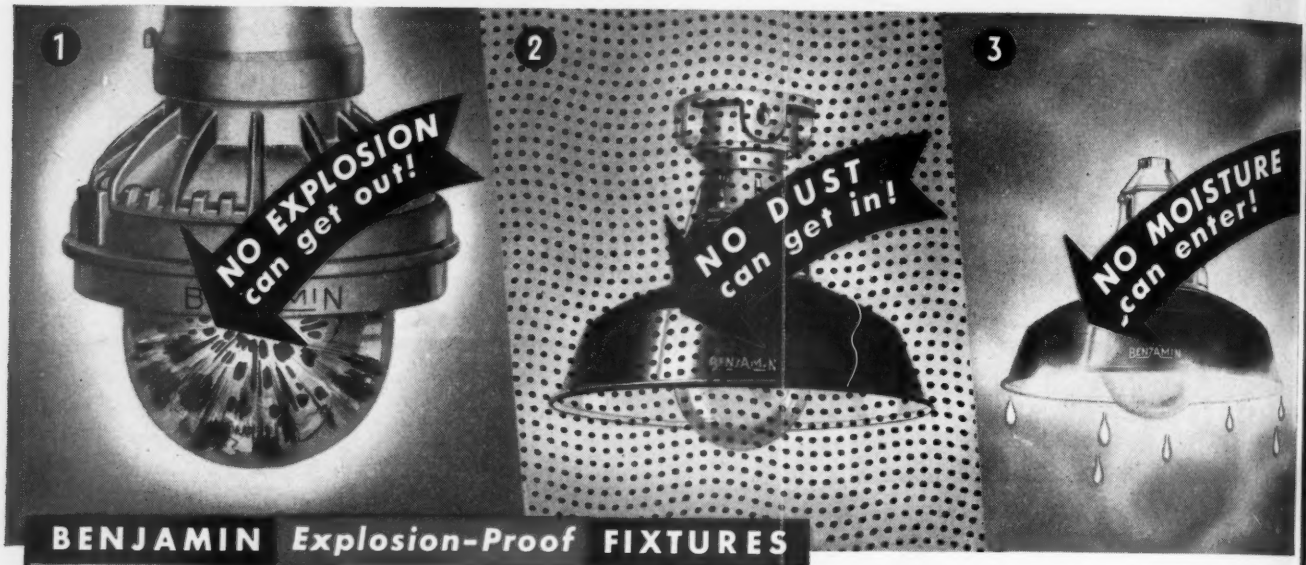
Interpretation No. 251

STATEMENT . . . Six to twelve individual single dwellings are built in a single row under one roof with individual entrances for the occupants. This is a Federal housing project for war emergency and the buildings constructed on wood frames with wall board interior finish. One 3-wire 110-220 volt a.c. service and service equipment is installed in one end dwelling of each group. No meters are provided. From the main service equipment individual 3-wire fused feeders are installed to each individual dwelling where they supply a fuse panel which supplies two branch circuits of No. 12 wire with non-metallic sheathed cable.

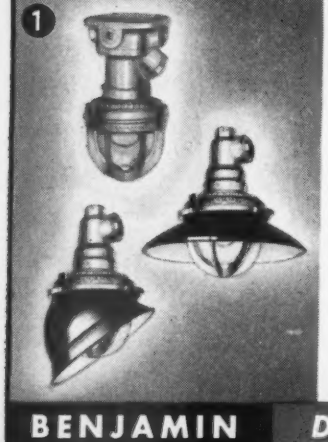
QUESTION . . . Under Interim Amendment No. 43 to section 3372 of the 1940 National Electrical Code, may the feeders to individual single dwelling be of non-metallic sheathed cable with an uninsulated grounded circuit conductor?

ANSWER . . . Yes.

Important Facts you should Know about Benjamin *Explosion-Proof*, *Dust-Tight* and *Vapor-Tight* Lighting Equipment



BENJAMIN *Explosion-Proof* FIXTURES

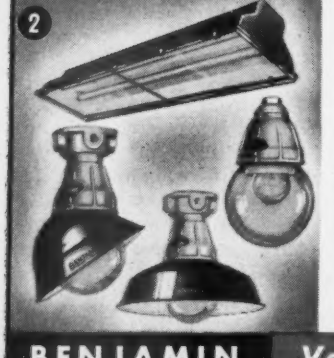


Constructed to:
Confine Explosions Within Fixture.

These units meet the severe spark plug test in which spark plugs are used to create ignition of explosive mixtures within the fixture 30 or more times. Tested also to withstand hydrostatic pressures ranging to 380 lbs. per sq. in. For Class C (Ethyl-Ether atmospheres) a series of 50 additional explosion tests are met. Benjamin units are neither destroyed nor damaged by such tests nor do they permit the passage of flames or dangerously hot gases to escape to the surrounding atmosphere. Further, they pass all tests for operation at safe temperatures below the ignition temperature of the explosive atmosphere.

Uses: Listed by Underwriters' Laboratories for Class I, Group C and D hazardous locations, which include locations where flammable volatile liquids, highly flammable gases, mixtures or other highly flammable substances are used, handled or stored in other than their original containers.

BENJAMIN *Dust-Tight* FIXTURES



Constructed to:
Prevent Penetration of Explosive Dust to Lamp and Operate at Safe Temperatures.

Tests passed by these Benjamin fixtures include: Dust-Tight Test, 6 cycles of on and off operation at maximum room temperatures in a whirlwind of explosive dust-air atmospheres; Temperature Test, safe operation of fixture when covered with a heavy blanket of ignitable dust; a 35-hour, 2000 r.p.m. Vibration Test.

Uses: Listed by Underwriters' Laboratories for Class II, Groups E, F, G, and Classes III and IV hazardous locations. Includes such locations where the air may become laden with combustible dusts or where easily ignitable fibers are present. Also where dusts may settle upon ordinary fixtures in excessive quantities.

BENJAMIN *Vapor-Tight* FIXTURES

Constructed to:
Exclude Harmful Amounts of Vapor, Gas, Water and Dusts from Interior of Fixture.

These fixtures are highly resistant to penetration of moisture and non-flammable dusts, gases, or vapors. They meet Benjamin's high standards for performance and their dependability is attested to by their years of service throughout industry.

Uses: Listed by Underwriters' Laboratories for Class II, Group G and Classes III and IV hazardous locations. Includes locations where non-flammable gases or vapors are present or where non-combustible dusts exist.

Severe Tests and Years of Service demonstrate Dependability of these Special Benjamin Fixtures

Illustrated here are the three groups of Benjamin fixtures for use in hazardous locations. Fixtures in each group must pass stringent tests for conditions far beyond those found in actual service. Some of these tests are given in the chart at left, together with typical applications for each group.

Benjamin's years of experience in the manufacture and installation of such fixtures give assurance of maximum protection against fires, explosions and lighting interruptions due to hazardous or other abnormal atmospheric conditions. In the solution of special lighting problems involving the use of such equipment, Benjamin's experience and engineering recommendations are available without cost or obligation. Write for Free Data Bulletins containing detailed information concerning all of Benjamin Hazardous Location Lighting Equipment bearing the label of the Underwriters' Laboratories. Address Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

BENJAMIN TRADE MARK

HAZARDOUS LOCATION *Lighting Equipment*

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

INDUSTRIAL ELECTRIFICATION

ENGINEERING • INSTALLATION • MAINTENANCE

Direct Current Motors and Control—II

In the selection of control, careful consideration should be given not only to duty cycles, but also convenience to operator and the economic factors

THE wide range of types of direct-current motor control, both manual and magnetic, gives the purchaser a broad selection. However, to take full advantage of the many control equipments on the market he must make intelligent decisions based on a broad background of control knowledge.

Manual vs. Magnetic

A number of factors must be considered in choosing between manual and magnetic starters. One of the disadvantages of the manual starter is its dependence upon the human element. This is especially true of drum and face-plate types. The operator, a little behind schedule or plain careless, often gives the controller rough treatment, cutting out resistance too rapidly. The multiple-switch starter has some advantage in this respect since it requires both hands, with a hand-over-hand action, affording some degree of retardation in the short-circuiting sequence. Magnetic control, of course, takes the sequence action of shorting starting resistors out of the operator's hands entirely. Manual starters will, however, perform very satisfactorily if intelligently operated.

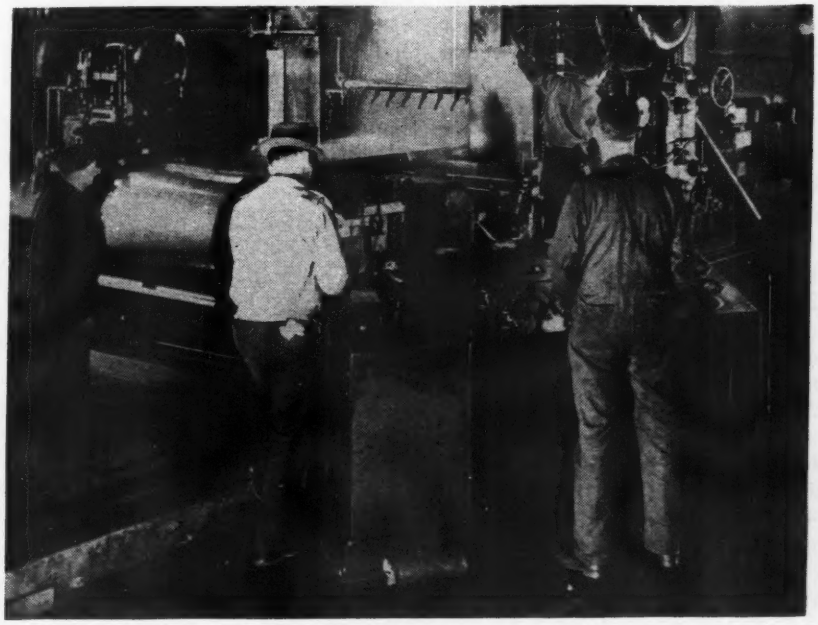
Manual control can handle only limited currents and voltages and therefore are available only up to certain horsepower and voltage ratings. Line shaft motors, pumps, fans and the like which are started and stopped infrequently are quite adaptable to manual control. In general, manual starters are not designed, as are magnetic starters, to withstand rapid operation. Consequently, maintenance and renewal of worn parts on manual control will increase more rapidly as frequency of operation increases. Manufacturers recommend that, in general, if more than five to ten starts per hour are necessary magnetic control is indicated.

The operator too should be given every consideration. Undue fatigue can be caused by manual operation of starters, especially heavy duty type on large motors even on infrequent starting schedules. Whereas pushbutton stations used in conjunction with magnetic controllers require little effort.

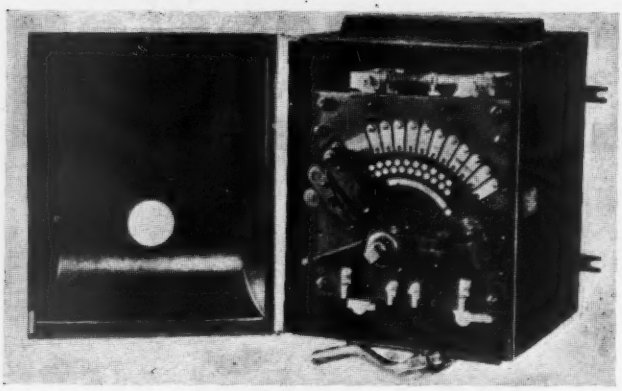
Available space is another factor entering into control selection. If the operator is using manual control, it must be located convenient to his working area. Very often space is not available to mount the controller within easy reach. Here again magnetic control is indicated. It can be mounted at any convenient point to the motor (even at a remote location) with only a pushbutton station mounted within easy reach of the operator. Or if the operations require the operator to control the motor from more than one point, any number of pushbutton stations may be placed at his convenience.

Magnetic control has the further advantage of accomplishing interlocking control of sequence operations where a number of motors must start and stop in a predetermined manner.

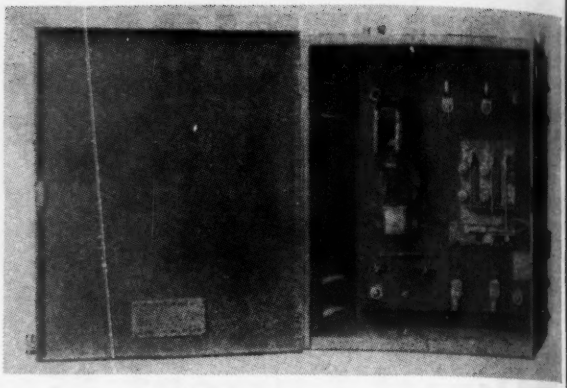
Manually operated across-the-line



TANDEM COLD-STRIP mill stands are driven by adjustable speed d.c. motors and are remotely controlled by units such as these.



SPEED REGULATING RHEOSTAT used for starting and regulating speed of shunt and compound wound motors by shunt field control for non-reversing service only.



PROTECTIVE PANELS such as this are used with drum controllers to provide overload and low voltage protection. A thermal overload relay operated by two heaters is used.

switches are available in sizes up to 1.5 hp. at 115 volts and 2 hp. at 230 volts. For larger motors, resistance starters are necessary to limit the inrush armature current on starting. The three general types are face-plate, drum and multiple switch starters.

The multiple switch starters are constructed with a series of switches which must be closed manually in a left-to-right sequence. Successive portions of the starting resistance is cut out as each switch is closed. The switches are so mechanically interlocked as to prevent closing in any other sequence than the proper sequence. Each successive switch mechanically locks-in the preceding one. The last switch is locked-in by a catch which is held by a low voltage protection magnet. Ratings run to 150 hp. and are especially adaptable to large motor manual starting because of the time element introduced by the hand-over-hand closing procedure necessary. Multiple switch units are for starting duty only without dynamic braking and for non-reversing service of either shunt, series or compound wound motors.

Face-Plate Controllers

Face-plate controllers can be subdivided into four general and more or less standard classifications:

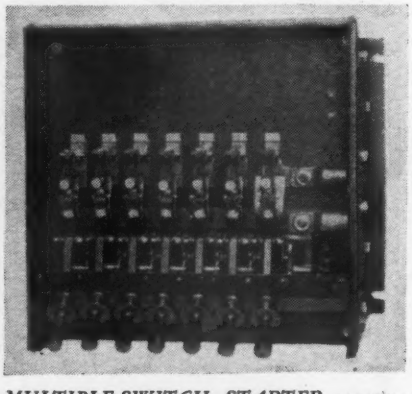
1. For starting duty only.
2. For starting and regulating duty and providing speed increase up to four times full-field speed value by field control only.
3. For starting and regulating duty providing a minimum of 50 percent speed reduction by armature control only.
4. For starting and regulating duty providing a 50 percent speed reduction by armature control and 25 percent increase by field control.

Two classes of service can be obtained from speed regulation by armature control, that is, carying torque and constant torque. Varying torque applications would include fans, blowers, centrifugal pumps and other similar loads where the torque varies approximately as the square of the motor speed. Constant torque applications would include machine tools, plunger type pumps and similar loads where the horsepower output of the motor decreases directly with the motor speed while the torque remains constant.

Face-Plate Operation

The contactor arm of the face-plate starter is provided with a spring which tends to retain the handle in the "off" position. After the motor has been accelerated to full speed, the contactor arm is held in the "run" position by a magnet coil which is connected across the line. This affords the motor low voltage protection, for in case of power failure, the magnet releases the contactor arm which is carried back to the off position by the force of the spring.

The speed regulating rheostats have two contact arms, one for starting and one for regulating speed. The operating handle and the regulating arm is pinned to a common shaft, while the starting arm is spring-retained. In starting, the starting arm is pushed to the running position (by the regulating arm) where it is held by the low voltage release magnet while the regulating arm is carried back to the correct point for the desired speed.



MULTIPLE-SWITCH STARTER requires hand-over-hand closure to short out starting resistance, and thus provides a certain inherent time-delay element into the starting procedure.

Armature control rheostats start the motor at half speed; by carrying the regulating arm back in the opposite direction, the speed can be increased to full basic speed by increasing armature voltage; and by carrying the regulating arm back further still, increased speed beyond basic can be obtained by field control.

Face-plate controllers of the first two classifications are generally equipped with standard NEMA classification resistors that provide 100 percent torque on the first point for ratings up to 50 hp. at 230 volts and are suitable for 5-second starting once every 80 seconds. Resistors are used on ratings over 50 hp. that provide 150 percent torque on the first point and are suitable for 30 second starting once every four minutes.

Standard starters for starting duty only can be obtained in ratings up to 75 hp. at 115 volts and 150 hp. at 230 volts. Starting rheostats equipped with field control only can be obtained in the same ratings as for starters. The number of points of field control may be as many as 24 for motor ratings up to 25 hp. at 115 volts and 50 hp. for 230 volts, and up to 66 points for larger ratings.

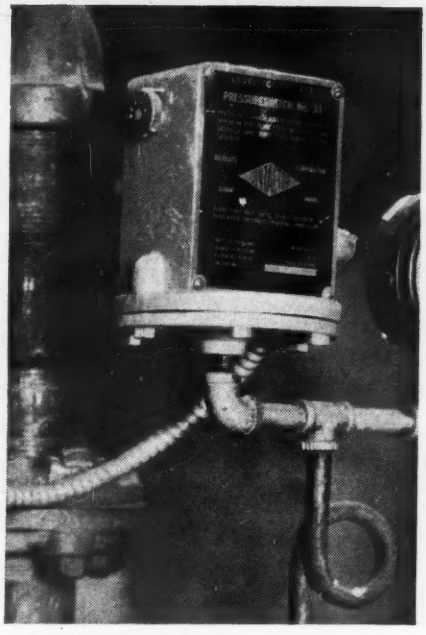
The armature-control rheostat is equipped with continuous duty resistors (NEMA No. 93 for varying torque applications) which are designed to give 50 percent speed reduction at not less than 35 percent of full-load torque. For constant torque applications, continuous duty resistors (NEMA No. 95) are used which provide 50 percent speed reduction at not less than 80 percent torque.

Rheostats providing armature control only are available up to 25 hp.

at 115 volts and 40 hp. at 230 volts with from 9 to 15 points of armature control. Rheostats providing both armature and field control can be obtained in horsepower rating up to 10 hp. and 20 hp. at 115 volts and 230 volts respectively with either 9 or 10 points of armature control and 7 points of field control.

Drum Controllers

The drum controller, used for starting and controlling adjustable speed motors, has speed ranges of four to one or less. They are designed especially for machine tools and similar applications where complete control of the motor from one operating handle is desired. The controllers are available for reversing or non-reversing service and for armature-starting field-regulating. Controllers are rated up to 20 hp. at 115 volts and up to 35 hp. at 230 volts. Three points are provided for armature starting in either the forward or reverse direction; up to 17 field regulating points are provided for speed control. The standard units can be obtained with dynamic braking by the addition of a dynamic braking resistor, and in some instances a magnetic contactor. A protective panel can also be provided to obtain overload and low voltage protection. Drum controllers are generally provided with a reset contact that requires the drum to be returned to the "off" position before the protective panel can be reset after overload or voltage failure. Protective panels are available in ratings up to 150 hp. Overload protection is afforded by instantaneous thermal relays having inverse time characteristics for normal overloads but trip instantaneously on abnormal overloads of approximately 400 percent or greater. Reset can be manual (after returning controller to off) or can be made automatic.



A PRESSURE SWITCH such as this is used in conjunction with a magnetic starter for complete automatic control.

Magnetic Starters

Magnetic starters are used for applications where semi-automatic or automatic control is desired. Semi-automatic control requires manual actuation such as an operator pushing a button for start or stop, inch, or forward or reverse. Completely automatic operation exists when the control is operated by a float switch, a pressure switch, a limit switch or the like.

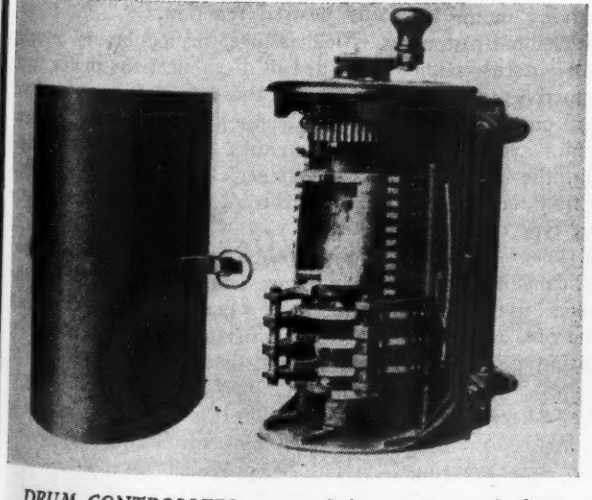
Magnetic starting is especially adaptable to frequent-starting operations; or when the motor is at some distance from the operator, when space does not permit mounting a manual controller near the operator; or when large motors require commutation of heavy currents.

The three main classifications of magnetic starters are definite-time-limit, current-limit, and counter-emf. Counter-emf acceleration uses a form of current-limit acceleration. The accelerating contactors close in succession as the voltage across the armature increases until the motor is finally brought to full speed with the closing of the last accelerating contactor. This type of control is generally limited to motors rated 5 hp. and below.

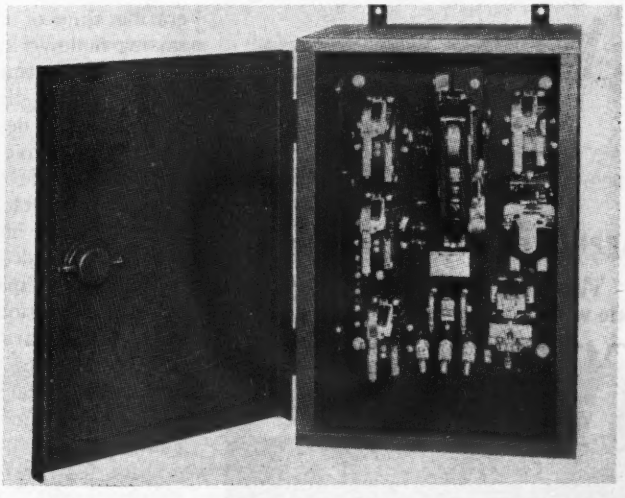
Current-Limit

Acceleration by current-limit depends entirely upon armature current values and contactor operation may be adjusted to any predetermined value. For instance, when the start button is pressed and the main line contactor closes with all the starting resistance in the circuit, a certain value of inrush current (say 150 percent) is encountered, which finally decreases to some value, say 115 percent. At 115 percent, the first accelerating contactor closes shorting out part of the resistance, and the inrush current immediately increases only to decrease again as motor speed picks-up. This increases the counter-emf, and the second accelerating contactor closes when the current decreases to the preset value, etc.

Current-limit acceleration is entirely dependent upon load. Light loads will accelerate rapidly and heavier loads will require a longer time to accelerate. For this reason current-limit starting is not so satisfactory for varying loads. It is entirely possible that under heavy-load starting, if the speed could not pick-up to the point where the current could be reduced to actuate the succeeding accelerating contactor, the motor would operate at that point with starting re-



DRUM CONTROLLERS are used for starting and shunt field speed control for adjustable speed d.c. motors. Designed for reversing service and speed range of four to one.



MAGNETIC STARTER that brings motor up to speed in a definite preset time for constant or adjustable speed, reversing or non-reversing with or without dynamic braking.

PUSHBUTTON stations convenient to the operator and requiring very little space for mounting is a big argument in favor of magnetic control.

sistance still in the armature circuit. Current-limit starting is most desirable for motors driving high inertia loads.

Definite-Time

Definite-time starters are simple in construction, accelerate the motor with low current peaks, use less power during acceleration, and always accelerate the motor in the same time regardless of variations in load.

Definite-time delay can be obtained by any of several methods. Escapement mechanism is one way of obtaining time delay. A pawl-and-ratchet mechanism attached to the gears of a timing device permit the operating solenoid to operate at a predetermined instant.

The operating solenoid may also be retarded by an adjustable dashpot, permitting the operator to vary the accelerating time of the driving motor by raising or lowering the dashpot piston.

Inductive time-limit acceleration makes use of the inductive time-lag effect of the decay of current in a heavily inductive circuit. Sometimes called magnetic timing, the inductive time-limit contactors may be of the normally open hold-out type or of the normally closed type.

In a similar manner, capacitor time-limit acceleration makes use of the constant discharge time of a capacitor in the sequence operation of the accelerating contactors.

Standard magnetic accelerating equipment is available in ratings up to 150 hp. for reversing or non-reversing service, with or without dynamic braking.

Braking can be obtained by several methods. Dynamic braking makes use of a discharge resistor placed across the motor terminals after the main contactor has disconnected the motor from the line.

Plugging is obtained by reversing the armature connections while running and accomplishes a very rapid reversal of the armature.

Magnetic brakes are used to obtain quick, accurate stopping, and to hold the load after stopping. Most brakes are electrically released and spring set, so that braking will be obtained even though an electrical failure should occur.

In addition to overload and low voltage protection, very often other types of protection are required. Over-speed or under-speed protection can be obtained by means of centrifugal governors or tachometers. Control functions may thus be initiated at any predetermined speed value to accomplish any desired reaction.

Field-failure protection is usually provided to disconnect the motor from the line in the event of an open shunt field in either shunt or compound wound motors. A relay coil is connected in series with the shunt field to give the signal on open-field condition.

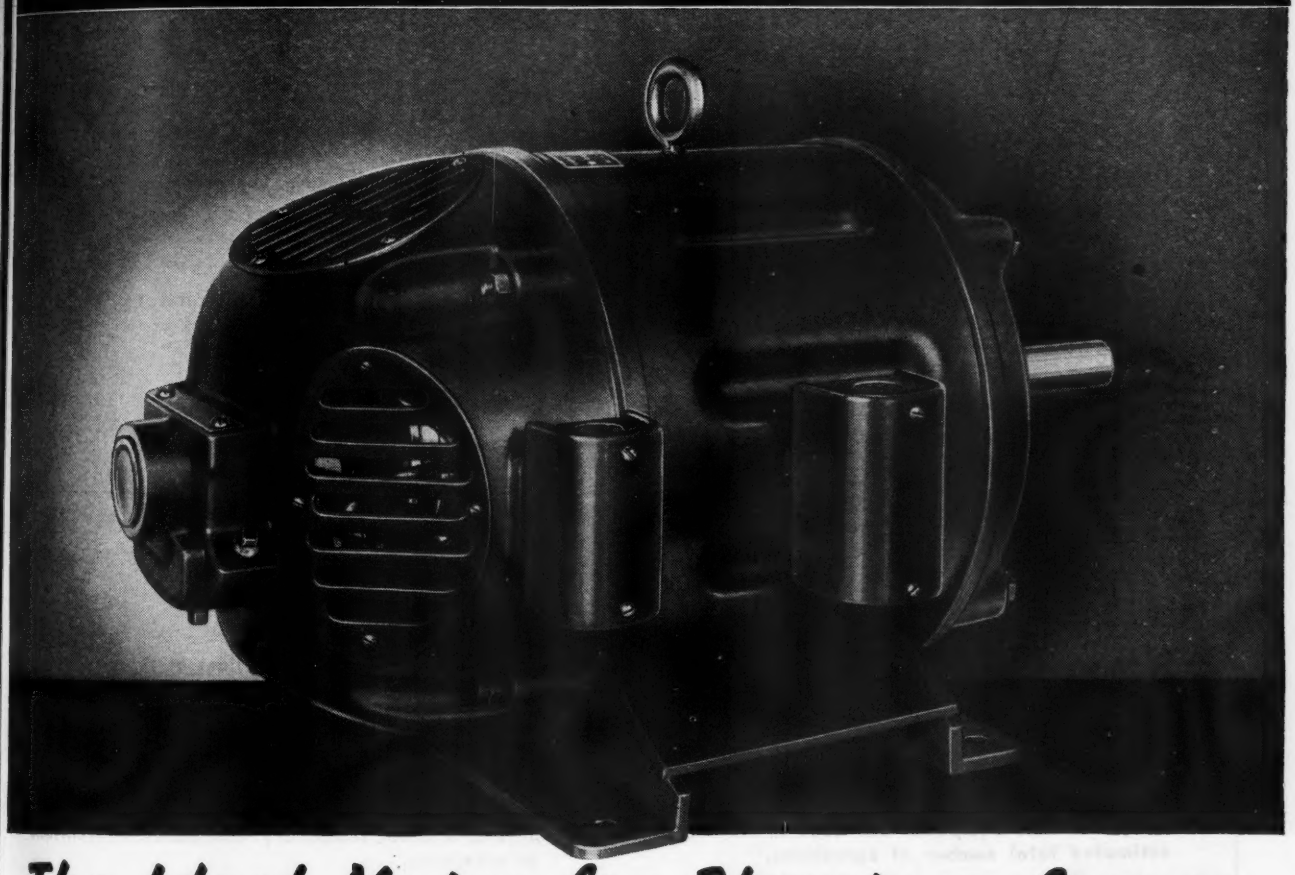
Field protective relays are often used to insert resistance in series with the shunt field when the motor is not in operation thus preventing overheating of the shunt field while the motor is at standstill.

When shunt field circuits must be opened, field discharge resistances should be provided to limit induced voltage to a value that will not damage field winding insulation when the field circuit is open.

Wagner

SLIP-RING MOTORS

FOR CONTINUOUS OR INTERMITTENT HEAVY-DUTY SERVICE



The Ideal Motor for Elevators, Cranes, Hoists and other Heavy-Duty Service

Here is a heavy-duty motor that is built to "take a walloping" and stay right on the job. Wagner slip-ring motors when operated in conjunction with proper control equipment have these important advantages:

1 Ability to start extremely heavy loads without affecting running characteristics.

2 No abnormal heating with repeated starting and stopping.

3 Variation in starting torque to meet varying torque requirements.

4 Smooth acceleration under heavy loads.

5 Higher starting torque with lower starting current.

6 Variation in operating speed, each reduced speed adjustable for a selected rpm for a given load.

MOTORS
TRANSFORMERS
UNIT SUBSTATIONS
INDUSTRIAL BRAKES
BRAKE LINING

M44-6B

WRITE FOR COMPLETE INFORMATION . . .

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NATIONAL SECURITY AWARD

Wagner Electric Corporation

ESTABLISHED 1891

6413 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

C-1

Trouble Shooting Control Equipment

IN AN EMERGENCY . . .

Three tips which will help the electrician get inoperative control back into service in a hurry.

KNOW YOUR CIRCUIT

1. Become fairly familiar with each circuit and the operation of each new controller as it is installed in the plant.

WIRING DIAGRAM

2. Keep the elementary diagram handy. This is the most valuable tool that the control manufacturer can furnish for use in trouble shooting. In many plants these diagrams are framed and kept near the controllers to which they refer.

PORTABLE INSTRUMENTS

3. Keep a portable instrument handy for checking voltage, current, resistance, etc.

ORDERING PARTS . . .

Send to the manufacturer at least one sample of broken or damaged parts and give him as much of the following information as possible:

1. **Complete nameplate data on controller.**
2. **Nameplate data, and function of equipment on which the controller is used.**
3. **Manufacturer's requisition or order number, if available.**
4. **Duty cycle and details of operation.**
5. **Length of time equipment has been in service and estimated total number of operations.**
6. **Voltage and frequency conditions at the panel, and other pertinent electrical data.**
7. **Complete description of manner in which failure occurred, including all mechanical, electrical and surrounding conditions noted.**
8. **Complete information on any unusual service conditions, whether temporary, continuous, intermittent or otherwise.**

OPERATING CONDITIONS . . .

It is also advisable to send along the user's opinion as to why the failure occurred, and any suggestions which he may have for preventing its recurrence.

Although, as a general rule, control equipment is designed to require the least possible maintenance, there are many cases which may require particular attention. Very often modification of the equipment might help overcome the difficulty.

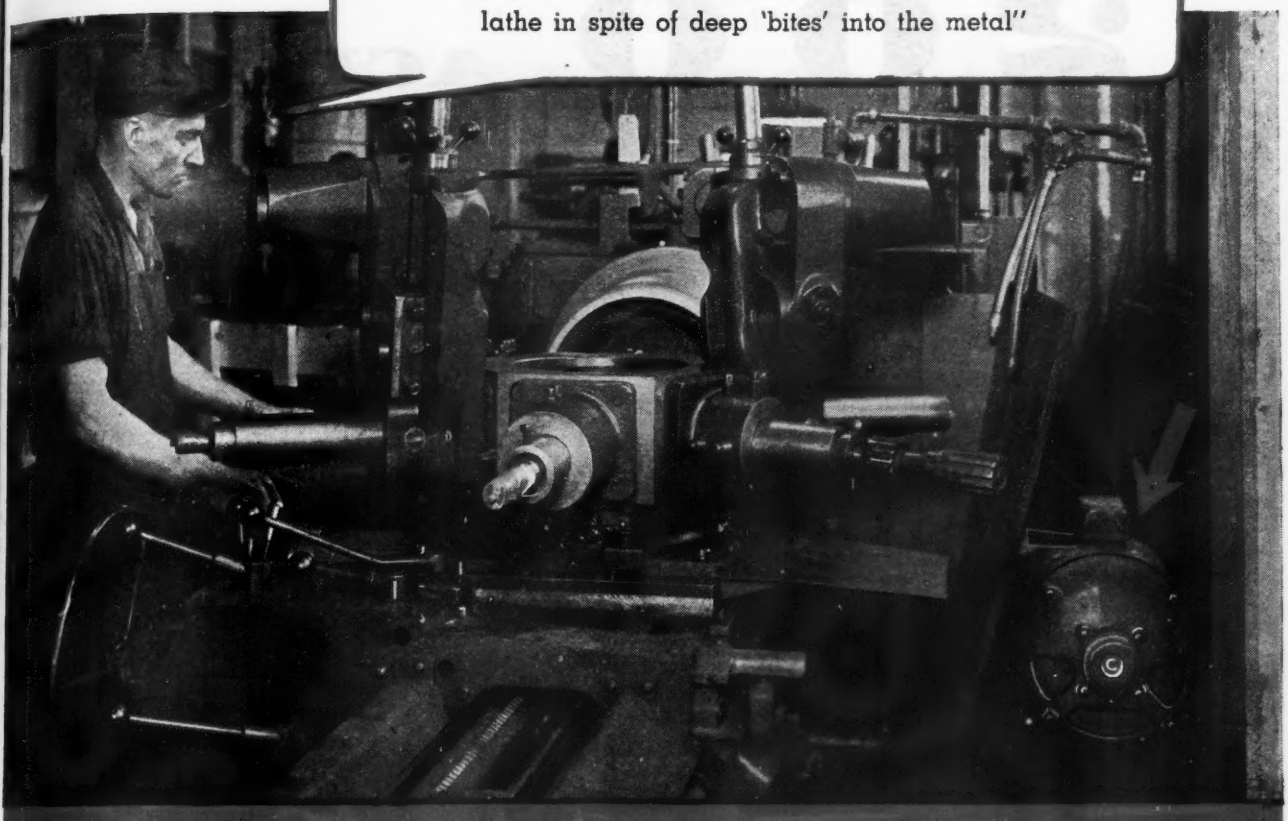
Unusual operating conditions should be called to the manufacturer's attention, as apparatus for use in such cases may require special construction or protection. The following are unusual conditions that are similar to the NEMA Industrial Control Standards covering unusual conditions.

1. **Exposure to damaging fumes.**
2. **Operation in damp places.**
3. **Exposure to excessive dust.**
4. **Exposure to gritty or abrasive dust.**
5. **Exposure to steam.**
6. **Exposure to excessive oil vapor.**
7. **Exposure to salt air.**
8. **Exposure to vibration, shocks, and tilting.**
9. **Exposure to explosive dust or gases.**
10. **Exposure to the weather or to dripping water.**
11. **Apparatus in cooling mediums having temperature higher than 40 C. or installed at altitudes greater than 6000 feet.**

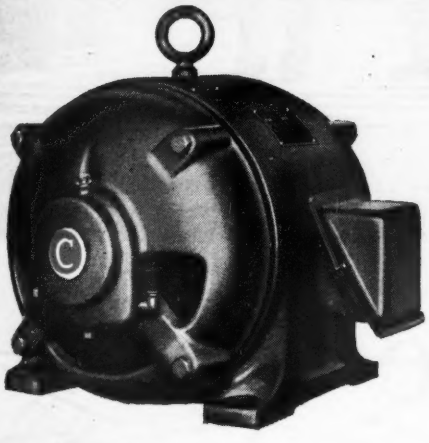
Information from General Electric Co.

[Continued on page 90]

"No grunts and groans from the Century motor on this lathe in spite of deep 'bites' into the metal"



CENTURY FORM J MOTORS Provide Extra Protection Against Falling Solids and Dripping Liquids



The Century Form J Squirrel Cage motor is ideal for machine tool applications such as the lathe shown above.

The 10 horsepower Century motor on this job furnishes adequate power for the deep rough cuts and the unusual freedom from vibration also contributes greatly to precision operations, when they are performed.

In addition, this Form J Squirrel Cage motor, which has the upper half of the frame closed, gives protection from the hazards of falling solids and dripping liquids.

Adequate ventilation to compensate for the partial inclosure, is provided by two powerful fans to force a blast of cooling air around the bearings and ventilating passages surrounding the windings.

Get complete information on the advantages of Century Form J motors — and the complete Century line, from 1/6 to 600 horsepower. The wide experience of the Century field engineer may prove valuable to you. He'll be pleased to help you with your problems, whether for today's production or your postwar plans.

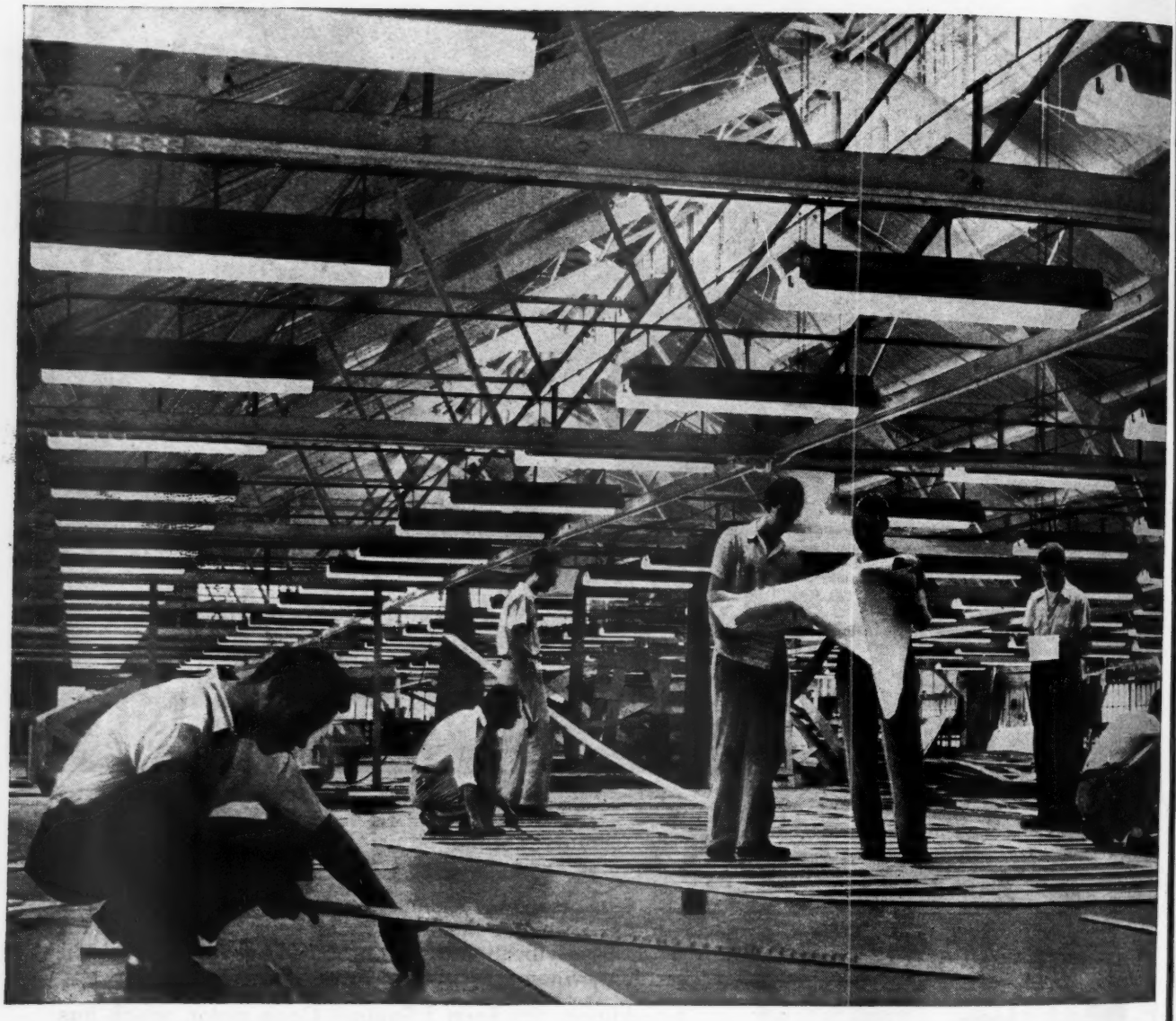
Century MOTORS

378

CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

200 ACRES OF B



Westinghouse

MAZDA LAMPS FOR SEE-ABILITY

LET'S ALL KEEP BACKING THE ATTACK . . . BUY MORE WAR BONDS!

Enjoy the Westinghouse radio program with John Charles Thomas—NBC, Sunday, 2:30 p.m., E.W.T.

BLUEPRINTS TO CHECK

See-ability, made possible *by today's high-efficiency Westinghouse Mazda Lamps, is helping build the greatest fleet in history. In one shipyard alone, draftsmen and engineers must work with more than 200 acres of blueprints in a single year. See-ability makes this vital eye-work easier, enables ship-building Americans to work faster and more accurately, with a minimum of fatigue. Through See-ability, efficiency is increased, output speeded, eye-strain reduced. For maximum See-ability and efficient, dependable service, be sure to recommend bright, long-lasting Westinghouse Mazda Lamps. Westinghouse Electric & Mfg. Co., Bloomfield, N. J. Plants in 25 cities . . . offices everywhere.*

Wartime lighting advances made by Westinghouse engineers will lead to higher lighting standards for postwar America, with new and better ways of using light in every kind of business, industrial, transport, commercial and home activity. Higher levels of light for schools will bring easier seeing, faster learning, better work. Light in new colors, lamps in new shapes and sizes, will offer a host of new display and merchandising opportunities to progressive stores and show rooms. Whatever your plans, be sure you take full advantage of Westinghouse lighting improvements.

DATA SHEET

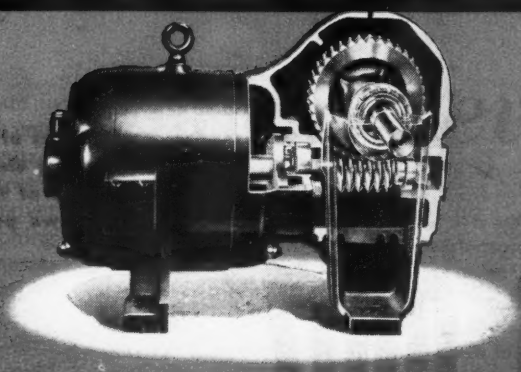
The number at the right is a classification for convenience in filing and for a future data sheet index

C-2

Trouble Shooting Control Equipment *(continued)*

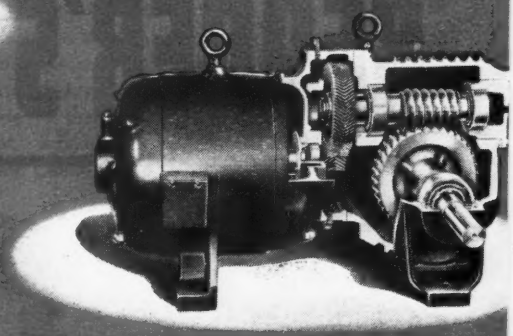
TROUBLE	CAUSE	REMEDY
CONTACTS		
Contact Chatter	Poor contact in control pickup circuit.	Improve the contact or use holding interlock.
	Excessive jogging.	Find out whether device is recommended for jogging service. If it is not, caution operator.
	Broken pole shader.	Replace.
	Contactor slams, thus opening interlock in coil circuit.	Increase wipe, also pressure on interlock.
Overheating of Contact Tips.	Copper oxide on contact tips.	Install silver-faced tips. If copper tips—file with a fine file. (Caution: excess filing wears out the tips. Never file silver-faced tips.)
	Carrying load continuously for a long time.	Install silver-faced tips.
	High inductive loads, such as d.c. fields.	Install silver-faced tips.
	Sustained overload.	Reduce current or install a larger device.
	Insufficient tip pressure.	Clean, adjust.
	Loose connection.	Clean and tighten. (Measurement of the milli-volt drop across the current carrying connections will indicate where excessive heating originated.)
Short-Circuit Currents on Contacts.	Feeder buses too large.	Eliminate short circuits or use smaller fuses in feeder.
Short Tip Life.	Interrupting high currents. (Note: tip life varies approximately inversely as the square of the current interrupted. Therefore, jogging may wear tips more than 30 times as fast as an equal number of straight starts, with stops from full speed.)	Install special tips designed to withstand arcing better than copper. (There are cases where these cannot be used because of their high resistance and lower rating.) Install larger device designed for jogging service.
	Excessive filing or dressing.	Never file silver tips. The rough spots will not hurt them.
	Oil-immersed device is a mis-application. (Note: Oil-immersed tips burn away from 20 to 40 times as fast as similar tips breaking the same current in air.)	Change to air-break device if oil is not essential.
	Mechanical rebound on dropout, causing tips to touch.	Reduce rebound, or report trouble to manufacturer.
Weak Tip Pressure.	Wear allowance gone.	Replace and adjust.
	Poor tip adjustment.	Adjust gap and "wipe."
	Low voltage which prevents magnet sealing.	Correct voltage condition (possible line regulation).
Welding or Freezing.	Abnormal inrush of currents of more or less than 10 times continuous rating. (This will vary, depending on the type of device.)	Reduce currents. Substitute special non-weld tips. Install larger device. Install copper tips. (Caution: overheating of copper tips should be considered.)
	Rapid jogging.	Install copper tips if otherwise suitable.

Information from General Electric Co.



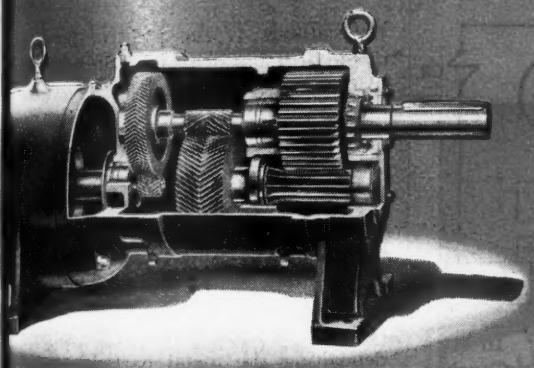
RIGHT ANGLE TYPE

RATIOS UP TO 72:1



COMBINATION TYPE

RATIOS UP TO 432:1

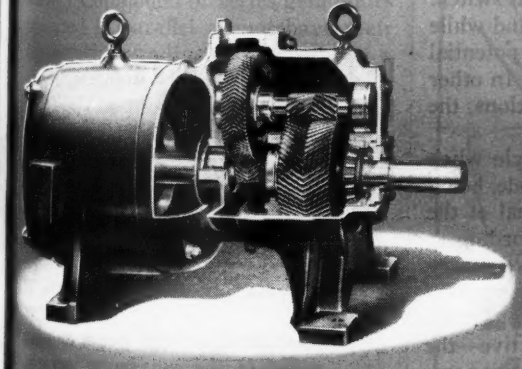


TRIPLE PARALLEL

RATIOS UP TO 120:1

MASTER

Only **MASTER** offers you a choice of FIVE different styles of Gearhead Motors from which to select a type of drive that meets exactly your individual requirements. Investigate MASTER'S unusual ability to serve you promptly and economically with motors ranging in size from 1/10 to 100 horsepower.

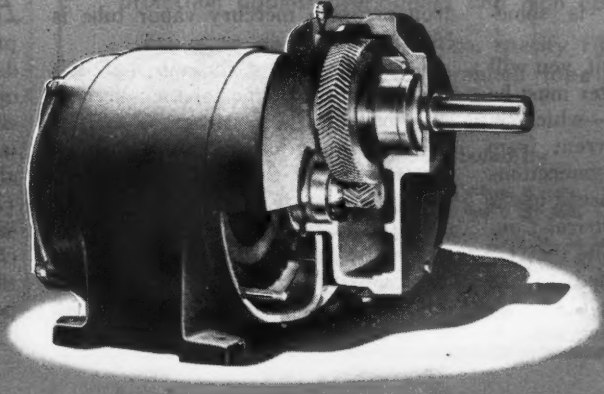


DOUBLE PARALLEL

RATIOS UP TO 36:1

THE MASTER ELECTRIC COMPANY

DAYTON, OHIO



SINGLE PARALLEL

RATIOS UP TO 6:1

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

READER'S QUIZ

CIRCUIT RECTIFIER

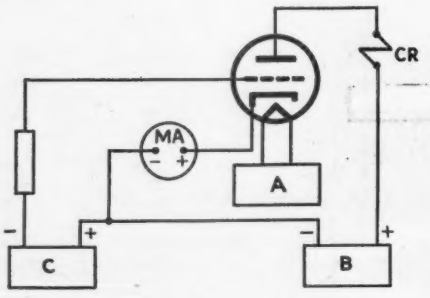
QUESTION 131. I note in a diagram of an aluminum plant rectifier circuit that the cathode of the rectifier tubes and cathode breaker are in the positive lead. Any electrical dictionary will show that the cathode is always negative. Can you explain this?—R.L.D.

A. TO QUESTION 131. The rectifier is not unlike a check valve and will pass (current) electrons in only one direction. The only time it will pass electrons is when the anode is positive with respect to the cathode. Now we have positively established a direction for the electrons. According to early conventions there would be a current flow in the opposite direction.

It is also true that any point in a circuit is neutral, i.e. its sign will depend upon the part of the circuit with which it is compared. The actual direction of current is of little consequence as long as the notation is consistently applied.—E.J.K.

A. TO QUESTION 131. Before the electron theory was advanced, electricity was assumed to travel from positive to negative, and all test equipment, meters, etc., were polarized accordingly. If the answers in electrical dictionaries mean that negative electrons are given off from the cathode, they are right. But when you speak of polarity as measured with conventional meters—that is something else.

In any vacuum tube circuit, you will find that the plus of the meter must be on or toward the cathode—which in turn gets the positive current from the plate (anode). Circuit connections are relative. For proof see Fig. 3, page 98 of Feb. issue, *Electrical Contracting*. The "B" minus, and the "C" positive are both connected to the cathode. (In this case the filament.) Without some rule to follow, what is



the polarity of this cathode? Insert a milliammeter in the circuit in such a way that only the cathode current is measured (see Figure). In spite of plus and minus battery connections—the meter plus must go to the cathode. —F.J.M.

A. TO QUESTION 131. The rectifier tube, with its anode and cathode, is a unidirectional switch. The "switch" operates when and while the anode is at a positive potential with reference to the cathode. In other words, under the above conditions, the tube becomes conductive.

During that part of the cycle when the anode is positive the cathode, being connected to the other terminal of the a.c. supply, is negative. According to the electron theory, the positive charge (or potential) of the anode attracts the electrons from the cathode; at this instant the tube is conductive—the current flowing in a series circuit composed of the tube, filter choke, load and a.c. supply.

The tube, although it is at this instant conducting current across its two elements, has some resistance since, for example, the average voltage drop across a mercury vapor tube is 15 to 20 volts.

The total load of the a.c. source is the resistances of the tube, choke, and load connected in series across it. The anode is at the positive extremity and the terminal of the load connected to the other end of the supply is at the negative extremity. All intermediate terminals, in this series circuit, are positive with reference to the negative terminal of the load, but negative with reference to the anode. Consequently, the cathode is the positive terminal of the load, but negative with reference to the anode, or the negative electrode of the tube.—F.L.B.

A. TO QUESTION 131. For a circuit containing a plating solution the electrode at which the plating occurs is the cathode and is negative. The current flows from the other electrode (anode) through the solution (electrolyte) and leaves at the cathode, depositing the metal particles (ions) as it does.

In a rectifier, the electrode at which the current leaves the electrolyte becomes positive because the current flow is from a source in which the anode is at the higher potential and the other electrode (cathode) is at a lower potential but is positive with respect to the external circuit.—J.E.W.

D. C. GENERATORS IN PARALLEL

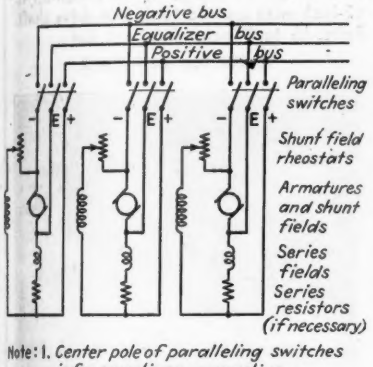
QUESTION 132. Is it possible to successfully operate in parallel three or more d.c. generators of different capacities, all driven by the same type of prime mover. If each is driven by different types of prime mover such as diesel and steam engines what is the maximum permissible speed regulation of each engine? Does each generator take its proportionate share of the load?—H.R.S.

A. TO QUESTION 132. It is quite possible, and a common practice, to operate any number of d.c. generators in parallel. For stable operation, however, they should have similar external characteristics. That is, as the load increases, the voltage of all machines should (1) decrease, or (2) increase approximately in the same ratio. The capacity of the machines does not enter appreciably into the picture from a practical standpoint.

Series generators, due to their ris-

ing characteristics will not operate in parallel unless an "equalizer" connection is provided. The equalizer causes all series fields to be affected alike if the speed of one prime mover should change. The same reasoning applies to compound-wound generators. Without the equalizer connection, a momentary change in speed of a prime mover would cause a load shift in such a way that one generator would be driven as a motor. (A series generator would try to reverse its direction of rotation when it became a motor.)

When operating a shunt generator in parallel with a compound generator, the compound generator should be operated without the series field, or it



Note: 1. Center pole of paralleling switches is for equalizer connection
2. Circuit breakers and instruments not shown

should be given a drooping characteristic by means of a suitable series field shunt. Compound or series generators operated in parallel cannot have their characteristics adjusted by means of a shunt because of the equalizer connection. Instead, the characteristics must be altered by means of a resistance in series with the series field.

Automatic voltage regulators may be provided for machines operating in parallel. If hand regulation is used, the voltage (and consequently the load) of each machine may fluctuate due to changes in speed of the prime movers. But this can vary over a wide range without system disturbances. Under normal conditions, with the generators having similar characteristics and the prime movers holding reasonably constant speed, the load carried by each generator can be varied by adjusting the field rheostat.

When the load on one machine increases to the point where it is necessary to add another in parallel, the incoming machine is brought up to its normal speed and its voltage is adjusted by means of the field rheostat until the running and "starting" machines have equal voltages. The paralleling switches are closed, and load is added to the incoming or starting machine by increasing its field strength.

When disconnecting a generator, reduce its load by weakening the field.

When the load current is nearly zero, the paralleling switch is opened.—L.E.B.

A. TO QUESTION 132. It is possible to operate as many d.c. generators in parallel as we want. We can use any type of prime mover we desire. Speed regulation does not count. The only thing that does count is even voltage for all generators, as otherwise, the high voltage generators will carry the load and also drive the low voltage generators as motors. Therefore use some form of a current regulator, which changes the voltage fast enough to keep the fuses of each generator from blowing in case the normal generator voltage characteristics of all generators are not alike for all loads.—H.S.

A. TO QUESTION 132. The answer to the first part of the question is definitely yes. They may be connected and operated in parallel quite effectively even though they are of different capacities, provided that the machines are shunt or compound wound, have the same voltage ratings and have identical operating characteristics. The last requirement may be explained by saying that each generator must react the same under various load conditions; for example, the voltage of all machines must increase or decrease the same amount with the application or removal of load. If the voltage of one increases over the others, then that generator will absorb a greater proportion of the load, and eventually overload that machine.

Generators of the compound wound type require a low resistance connection between the various machines, called an equalizer. This equalizer connects each machine at a point between the series field and the armature. The equalizer prevents one generator from absorbing more than its share of the load, due to the series field of that generator momentarily having an increase in current, due to a temporarily increased voltage across it. With the equalizer, the voltage increase is shared by all series fields alike. The equalizer is not required by shunt type generators operating in parallel.

In part two of the question, regarding the use of dissimilar prime movers, I would discourage the practice. However if it were necessary, I would recommend that their speed regulation shall not have a variation of over two to five percent, depending on the speed of the generators, i.e. two percent for low speed machines and up to five percent for high speed machines, if satisfactory results are to be had.

In answer to the last part of the

question, I would say positively yes. Of course, there are several qualifications to be considered. The speeds must be kept in step with one another in order to keep the voltages of the various generators identical or very close to it. The generators should be of the same make and voltage (although they may be of different manufacture) and the operating characteristics should be identical, as described in part one. In case of the compound generator connection, the equalizer conductor must be used as described in part two. Lastly I would advise against the combination of both shunt and compound machines in the same system as this complicates the operation in regard to load control. In considering the above items there should be no trouble in having each generator take on its proportionate share of the load.—W.R.S.

Can you ANSWER these QUESTIONS

QUESTION T5 I would like to hear how other readers improvise testing equipment for use in running a double-the-voltage-plus-one thousand test on lead covered cables. When energizing currents are too great for a continuously adjustable auto-transformer then a water rheostat is indicated. I find it practically impossible to get smooth control for the full range. Unless I add large amounts of salt, I cannot reach the peak voltage; then as soon as the movable electrode contacts the water I get a tremendous increase in voltage. How can I start the test at practically zero voltage and gradually increase until maximum test value is reached?—E.J.K.

QUESTION U5 In our motor repair shop, about 50 percent of the rewind jobs are 3 phase, from 1 to 15 hp. Three phase, 220 volt service is not available. Consequently we are at a loss as we cannot give these motors a running test since we have only single phase at 220 volts. Is there any practical way to change single phase to three phase without installing a single to three phase m-g set?—H.G.H.

QUESTION V5 We intend to install three used single phase transformers in a substation to step down a potential of 7,200 volts to that of 120 volts to neutral. The primary being three wire and the secondary four wire.

The load will consist of three phase induction motors and of the usual incandescent lighting load. The motor load will total 250 kva. at 0.73 power factor; the lighting load being 215 kva. at unity

power factor and is planned to be connected between the line wires and the neutral to achieve a balanced condition.

What primary and secondary voltage is required of the transformers? How shall the three single phase transformers be connected? What will be the full load currents in the primary and secondary windings?—P.C.Z.

QUESTION W5 I have a pole-line ground the resistance of which I would like to measure. There are two other separate grounds nearby that I can use to check with. I believe there is an instrument on the market that uses some method to figure ground resistances. I would like to know how it is done and what formulas are used.—F.G.K.

QUESTION X5 I was called in to repair a short on a three phase line feeding a cloth cutter. I traced the short to the molded three pole receptacle which was attached to the cord. After reconnecting the receptacle, it still blew the fuses even though I carefully removed the carbon from the molded parts. This meant that I had to use new molded insulation to keep the fuses from blowing. Can someone tell me how to tell the difference between a plastic that becomes a conductor after an arc and one that does not?—H.S.

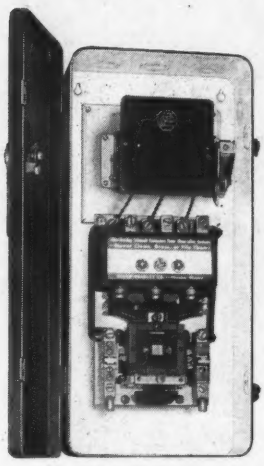
QUESTION Y5 We want to control six 200 hp. 440 volt motors at a remote point about three and one-half miles away, each motor to have separate start and stop controls, also separate continuous lamp indication of the running or off periods of the motor. We want to use a minimum number and size of conductors. What would be the best way to do this? There is available 110 volts on a control transformer at the motors, also 120–208 volts 60 cycles and 125 volt d.c. battery are available at the remote point. The motors are located on an average of about 2,000 feet apart, with the nearest one about one and a quarter mile from the remote point.—L.R.B.

QUESTION Z5 I have a type PDA-3A, 115 volt, 60 cycle voltage regulator operating in conjunction with a 2300 volt, 188.5 amp., 3 phase, 60 cycle, 120 r.p.m. generator that is directly connected to a reciprocating steam engine. The trouble I am having is with the control of the voltage which constantly rises and falls in step with the revolutions of the engine. The armature of the regulator also dips up and down in step. Can someone give me a solution for correcting this condition?—F.L.C.

PLEASE SEND IN YOUR ANSWER BY JUNE 1

Simplify your

CONTROL INSTALLATIONS WITH COMBINATION STARTERS

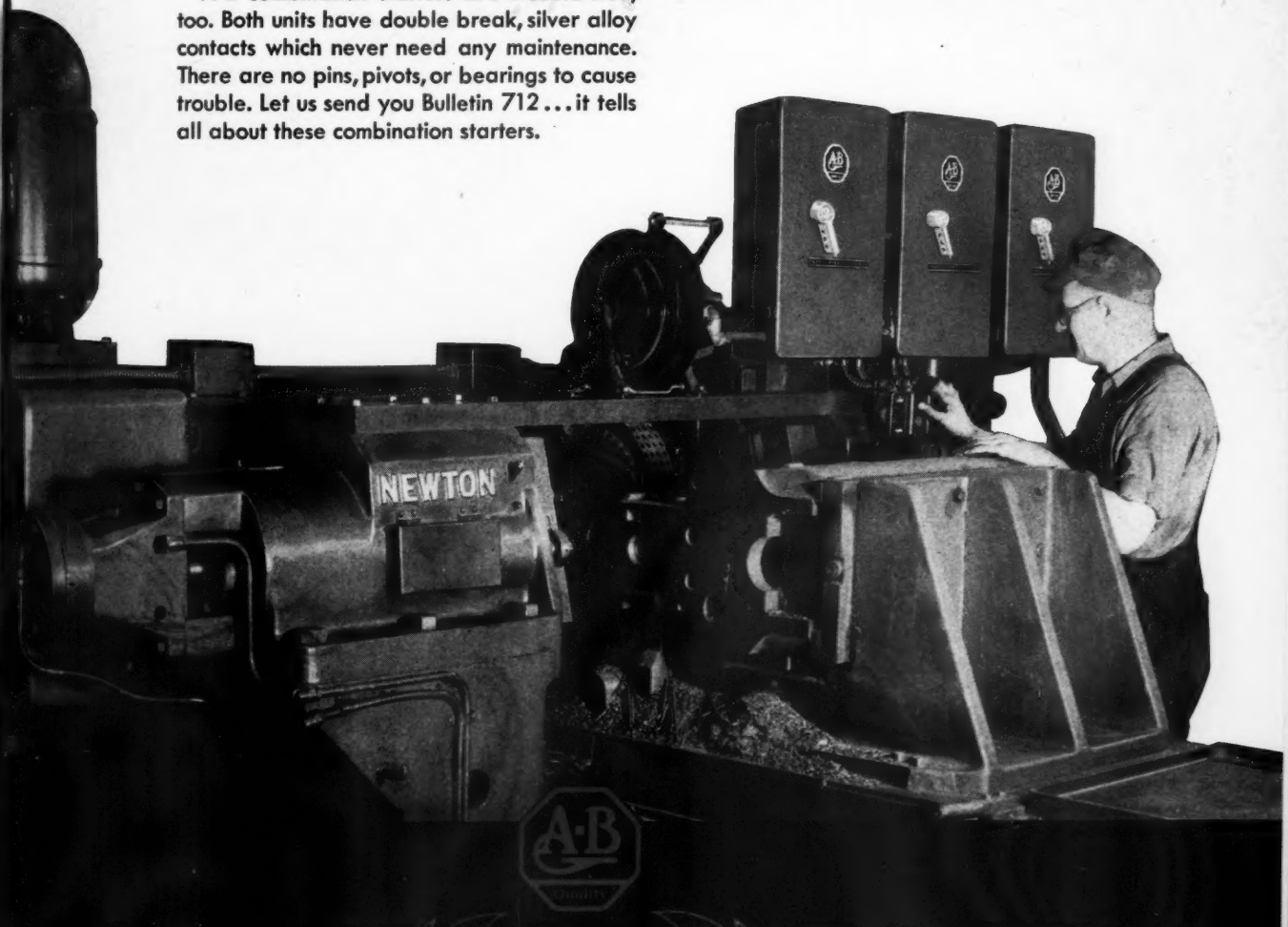


Two units in one cabinet

Bulletin 712 Size 2 combination starter with manually operated disconnect unit and solenoid starting switch in one cabinet. Three of these combination starters are used on the machine below.

Motor controls are easy to install when you use Allen-Bradley *combination* starters. You save time, space, money, critical materials, and man power. You get a neater installation, because solenoid starter and disconnect unit are in one cabinet.

A-B combination starters are trouble-free, too. Both units have double break, silver alloy contacts which never need any maintenance. There are no pins, pivots, or bearings to cause trouble. Let us send you Bulletin 712 . . . it tells all about these combination starters.

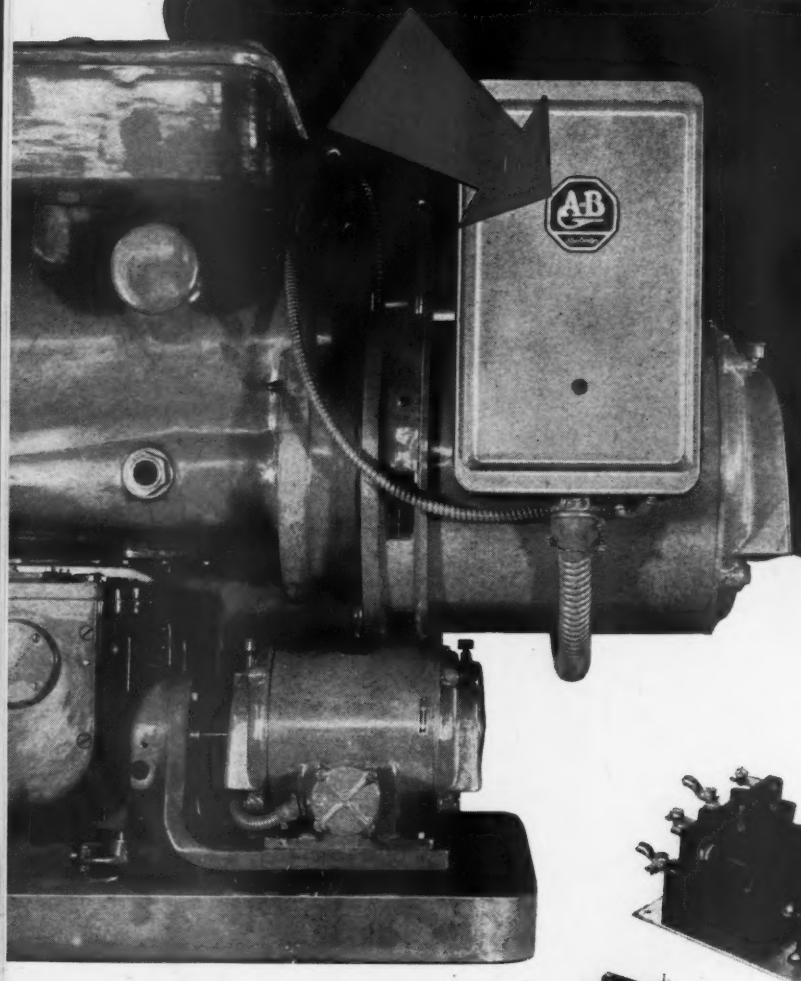


ALLEN-BRADLEY

COMBINATION STARTERS

QUALITY

Here's a sure sign of
TROUBLE-FREE MOTOR CONTROL



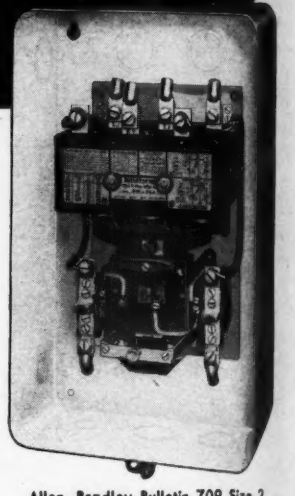
ONLY ONE MOVING PART

DOUBLE BREAK, SILVER ALLOY CONTACTS

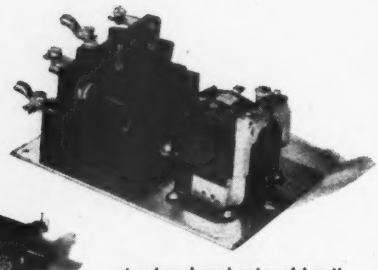
DEPENDABLE OVERLOAD PROTECTION

HIGH INTERRUPTING CAPACITY

SPLIT-SECOND ACCURACY

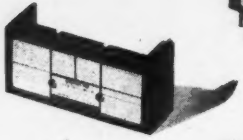


Allen-Bradley Bulletin 709 Size 2 Across-the-line Solenoid Starter

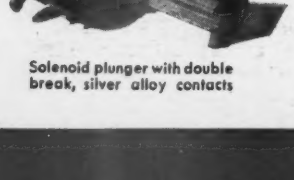


Arc hood and solenoid coil mounted on solid steel plate

Thermal overload relay



Arc hood cover



Solenoid plunger with double break, silver alloy contacts

The Allen-Bradley trade-mark is the mark of quality. A-B solenoid starters are dependable and trouble-free because they are so simple. They have only one moving part—the one-piece solenoid plunger that opens and closes the double break contacts with a straight-line vertical motion. There are no pivots, no pins, no bearings, no hinges, no flexible jumpers nor other trouble-breeders to cause starter failures. Furthermore, the silver alloy contacts never need to be filed, cleaned, or dressed. Just install A-B solenoid starters . . . and forget them. They're good for millions of trouble-free operations. That's why the A-B trade-mark means reliability and quality in motor control.

Allen-Bradley Company, 1316 S. Second Street, Milwaukee 4, Wisconsin.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

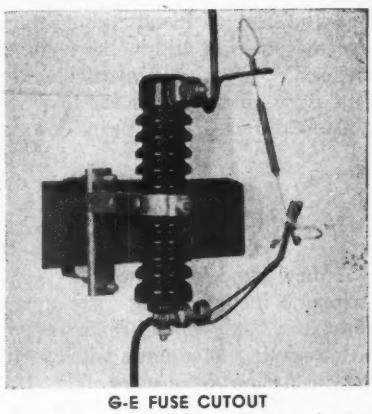
EQUIPMENT NEWS

Dualight Units

PITTSBURGH DUALIGHT UNIT

New dualight units are available for general or localized lighting of industrial plants. They are designed to approximate daylight from incandescent and mercury lamps. Each twin-hanger unit is tapped for ¾-in. conduit stem; is equipped with removable plate to simplify wiring; Mogul sockets, safety holders, Permaflectors and reflector retaining rings. Permaflectors, "shaped mirrors" of silvered glass, provide engineered light control for broad, medium or concentrated light distribution from low or high bay mounting. They use 500-watt PS-40 and 750 or 1,000-watt PS-52 incandescent lamp, in conjunction with a 400-watt T-16 mercury lamp. Pittsburgh Reflector Company, Oliver Building, Pittsburgh, Pa.

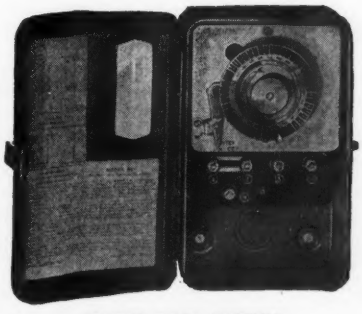
Flip-Open Fuse Cutouts



G-E FUSE CUTOUT

A flip-open fuse cutout, which provides overcurrent protection by means of a fuse link but without the conventional hinged fuseholder tube, has been announced. The cutouts, rated 5 amperes, 7500, 12,500 and 15,000 volts, have clamp type line terminals, wet-process solid porcelain insulator, and spring contact arms. The fuse is supported in tension between spring contacts. When the fuse link blows, the spring tension of the contacts widely separates the severed ends of the link, thereby giving visual indication of the blown fuse from the ground at any angle. A switch stick is used to re-fuse the cutout. The fuse link is constructed with solid wire rings at both ends to permit easy handling with a switch stick. General Electric Company, Schenectady, N. Y.

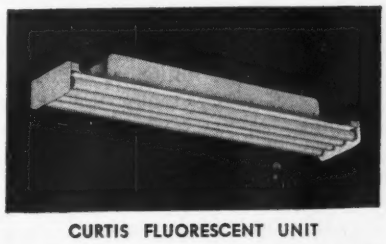
Time Switches



AUSTIN TIME SWITCH

A new line of time switches and time controls has been announced. The synchronous motor in these time switches is a slow speed, heavy duty motor, operating at an initial rotor speed of 450 rpm. It is self-starting and self-lubricating with built-in gear reduction of four heavy cut wheels and pinions operating in oil upon centerless ground studs within the sealed gear box. Type "S" standard synchronous time switches are recommended for controlling signs, commercial lighting, attic fans, stokers, oil burners, blowers, pumps, valves, motors, etc. It has two exposed gears. It is dust proof with slow speed motor and snap action switch enclosed in a modern case with glass window to check operation. Standard models are equipped with two tripper dials, one ON and one OFF. Four tripper dials are also available. The M. B. Austin Company, 108–116 South Desplaines St., Chicago, Ill.

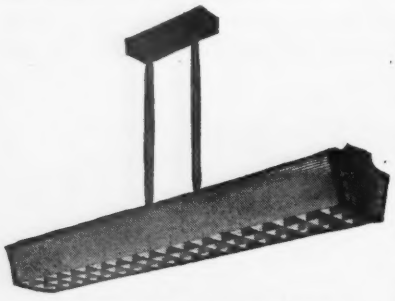
Fluorescent Luminaire



CURTIS FLUORESCENT UNIT

This luminaire, known as the Ranger, is for use in both offices and drafting rooms. It can be used individually and in continuous rows. It is an unshielded unit and can be converted into "Warrior" luminaires by obtaining the louver body and louver end plates. It has steel wiring channel and flat "Fluratex" non-metallic reflector, ballast shields and reflector ends. The dimensions are width 9½-in., length 48-in., suspension, top of ballast to bottom of wireway end plate 6½-in. It is wired for 110–125 volt, 60 cycle, a.c. current, high power factor tulamp ballasts. Unit can also be wired for 220–250 volts. It uses four 40-watt fluorescent lamps and is available in pendant or ceiling mounted types. Curtis Lighting, Inc., 6135 West 65th Street, Chicago, 38, Ill.

Fluorescent Unit



WAKEFIELD FLUORESCENT UNIT

A new fluorescent unit, called the Beacon, is for use in offices and drafting rooms. The unit is designed for high quality illumination, using etched ribbed glass for side panels to prevent glare and open louvers in the bottom of the unit to prevent direct view of the lamp. Lamp replacement is provided by a hinging arrangement of the louvers. It has an all-steel construction with exception of the louvers. A two-stem canopy construction using a special mounting strap reduces mounting time and cost of installation. Ballasts are mounted in an inverted position within the channel and are only partially enclosed. Units are available with stem suspension or with close-up mounting for low ceiling areas. The F. W. Wakefield Brass Co., Vermilion, Ohio.

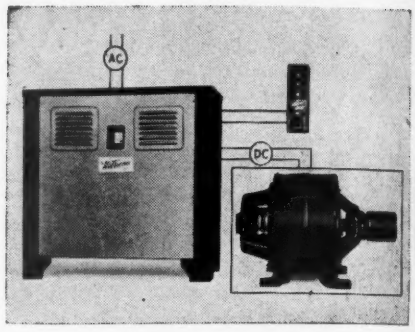
Wire Stripper

A new model of the Speedex wire stripper incorporating an improved automatic "stay open" feature provides a time-saving advantage when stripping the insulation from very fine stranded wires. The mechanism of the new tool is designed to hold the jaws of the stripper open until the wire is removed. A new handle design makes easier operation possible. The stripper removes insulation from all types of solid or stranded wire without crushing over a wide range of sizes from No. 8 to No. 30. It can be used to cut wire when desired. Hardened steel precision ground cutting blades are also available. Wood Specialty Mfg. Co., 919 Taylor Avenue, Rockford, Ill.

WIRE STRIPPER

Electronic Motor Drives

A line of adjustable speed, electronic motor drives providing d.c. motor performance from a.c. power without requiring special motors is announced. The new self-contained "package" units are applicable to any machine driven by a d.c. shunt motor. Electronic rectifier tubes are employed in the Weltronic system to convert a.c. to d.c. supplying separate power to the d.c. motor armature and field circuits. Each circuit is individually controlled through other electronic tubes to provide speed adjustment and current regulation. Full torque can be provided at the lowest speeds making it possible to vary the speed of a machine without sacrificing torque. Complete stepless control of motor speed is obtained from a few r.p.m. to double basic motor speed by setting a dial. Adjustment of the dial may be made while the motor is operating or it may be preset before starting. In addition to the start, stop and speed selection controls of standard units, reverse, with or without an independent reverse speed selection control, can be supplied. Dynamic braking, dual-control stations, limit switches or sequence and time controls may be used with the units as desired. All transformers are built into the steel cabinet. Units may be wall or floor mounted at any convenient location. Capacities are available from ½ hp. to 3 hp. single phase and 5 hp. to 10 hp. three phase. Standard voltages are 220/440 at 60 cycles. 550 volt and 25 or 50 cycle machines can be supplied. Weltronic Company, 20735 Grand River, Detroit 19, Mich.



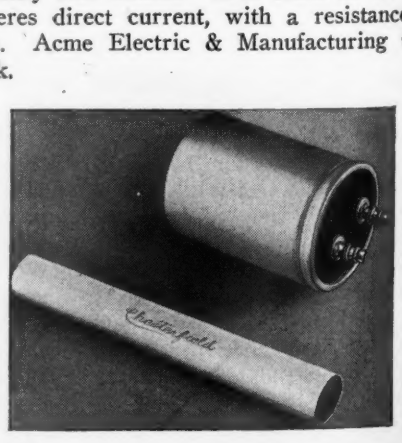
WELTRONIC MOTOR DRIVES

Building Wire

A new small-diameter Type SNW Flamenol building wire for wet locations has been added to the standard Type SN Flamenol for dry locations. This new wire has a special thermo-plastic insulation with low moisture absorption. It is designed for use in accordance with Section 3035 of the National Electrical Code for installations in raceway systems in wet locations. It is approved by the Underwriters' Laboratories in sizes 14 to 4/0 inclusive. The insulation, in addition to its low moisture absorption properties, is superaging, high in dielectric strength and resistant to oils, acids and alkalies. It is flame resistant and will not support combustion. Its temperature rating is 50 deg. C. This wire is self-protecting and requires no braid. Its finish is hard, smooth and glossy, striped for grade identification. The small diameter of this wire saves space permitting more conductors to be used in one conduit or duct, or permitting smaller conduits or ducts to be used. General Electric Company, Bridgeport, Conn.

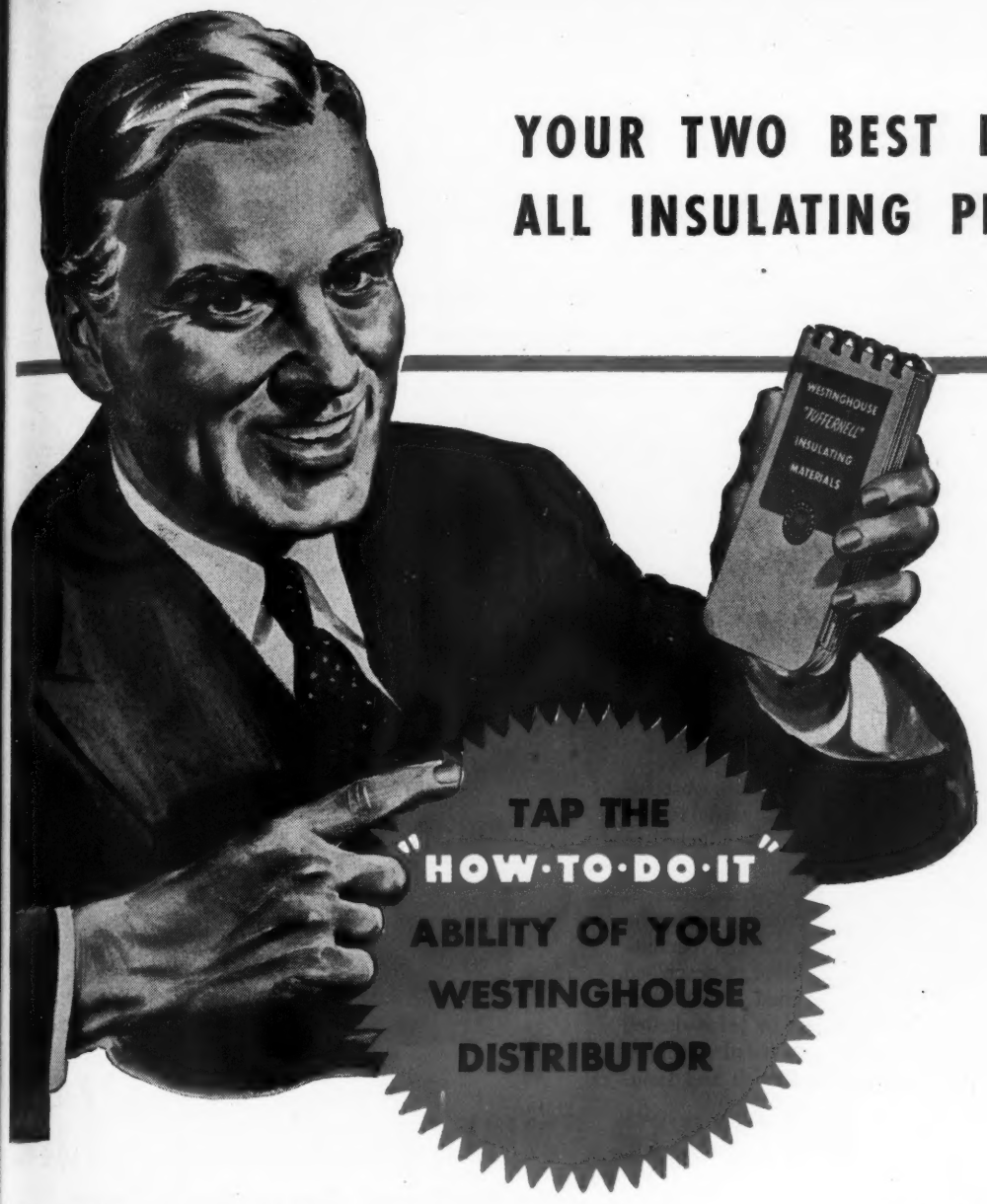
Midget Transformer

A transformer that compares in size with an ordinary cigarette has been announced for certain electronic applications. This transformer in an aluminum case is one inch in diameter and 1⅞-in. in height overall. The weight is approximately two ounces. It is rated at 1.4 henries at .025 amperes direct current, with a resistance value of 100 ohms. Acme Electric & Manufacturing Co., Cuba, New York.



ACME TRANSFORMER

YOUR TWO BEST BETS ON ALL INSULATING PROBLEMS



Your Westinghouse distributor offers two quick solutions to your electrical insulating problems.

First: The complete Westinghouse line of "Tuffernell" Insulating Materials—proved by 50 years of field tests with every type of electrical equipment.

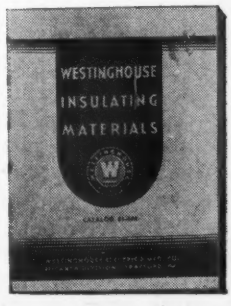
Second: The distributor's own "how-to-do-it" ability representing knowledge drawn from Westinghouse insulating headquarters and experience gained in similar applications for countless other customers.

Your Westinghouse distributor stocks a line of insulating materials that's really complete . . . from varnishes and cements to fabrics and tapes. And every material is "Tuffernell"—exactly what you need in flexibility, dielectric and mechanical strength.

J-90509

GET THIS NEW CATALOG

To simplify selection of the right insulation—your Westinghouse distributor now has available the new Westinghouse "Insulating Material Catalog". It contains listings of micas, fabrics, tapes and papers, along with complete dimensions, ratings and other helpful application data. Ask today for your copy of Catalog 65-000. Or, write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

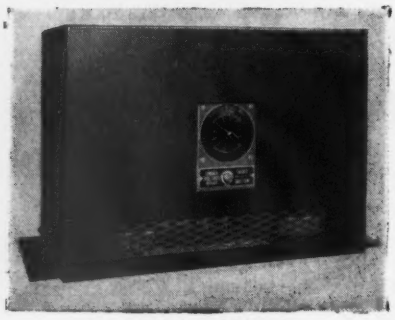


Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

SEE YOUR WESTINGHOUSE DISTRIBUTOR *FIRST!*

Welding Control



G-E WELDING CONTROL

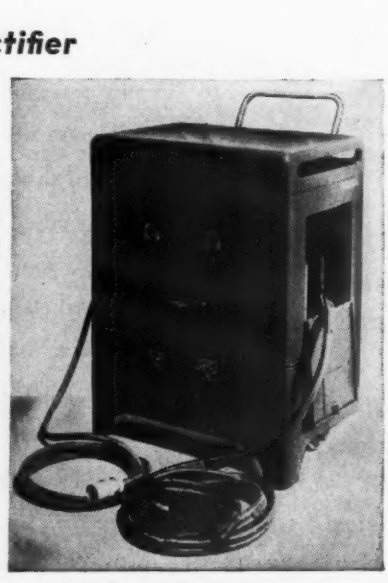
A new thyratron welding control for providing precise control of low-capacity spot welders has been announced. This control can be used with either welding tongs of a small bench welder, and is suitable for the spot welding of vacuum tube parts. Suitable for operation on either 230 or 460 volt, 60 cycle power supply the new control is an adjustable, synchronous-precision, electronic type in which three thyratron tubes perform all the functions. A single calibrated time adjustment on the front of the panel provides either one-half cycle or any number of complete cycles from one to ten. General Electric Company, Schenectady, N. Y.

An Alternate for Varnished Silk

A new seamless bias alternate for varnished silk obtainable in continuous length rolls of 36 or 72 yards is announced. The new material has been introduced to eliminate the need for splicing 51-in. bias cut strips. It is emphasized that whereas the sewed or cemented seams of spliced fabric often prove bulky or mechanically weak, the new alternate's freedom from seams or splices permits uniformly tight, compact taping. The product is described as a thin cotton cloth varnished to specified thicknesses, and is obtainable in either a slightly tacky or mica dusted finish. Dielectric strength is 1200 VPM and tensile strength is 42 lb. per one inch width. Irvington Varnish and Insulator Company, Irvington 11, N. J.

Heavy Duty Rectifier

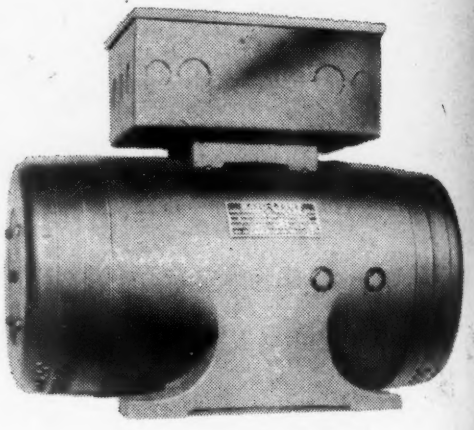
A new rectifier, heavy enough to operate modern, heavy duty aircraft gun turrets has been announced. The extra heavy inrush current required can be delivered while ample voltage is maintained to prevent drop-out of turret relays. The rectifier provides all power needs for the ground crew in servicing and testing planes of all sizes. It provides voltage control with a "no-load" limit that may be set and locked. The cabinet is designed for all-weather use and provided with roomy side compartments for holding long lengths of input and output cable. The standard model has a capacity of 20 to 28 volts at 200 amperes, with d.c. output starting inrush of 1200 amperes; a three minute rating of 400 amperes and continuous rating of 200. A.c. volts are 50/60 cycles, 3-phase, 460. Airplane Manufacturing and Supply Corporation, 6853 Lankershim Blvd., North Hollywood, Ohio.



HEAVY DUTY RECTIFIER

Motor Generator

A new line of high frequency motor generators has been announced. The machine is a motor and a generator with frames cast integral. The cores of the motor and generator are two distinct armatures but are mounted on one shaft. Many combinations of a.c. voltages and frequencies can be had in this unit such as either 400 or 800 cycles. Motor winding may be tapped to deliver 60 or 120 cycles at either 1800 or 3600 r.p.m. Voltages up to 1000 watts may be furnished. Frequency regulation is 1.6 percent at 1000 volt-amperes. The unit is approximately 16⅜-in. long; 8¾-in. wide; 13¼-in. high. Kato Engineering Company, Mankato, Minn.



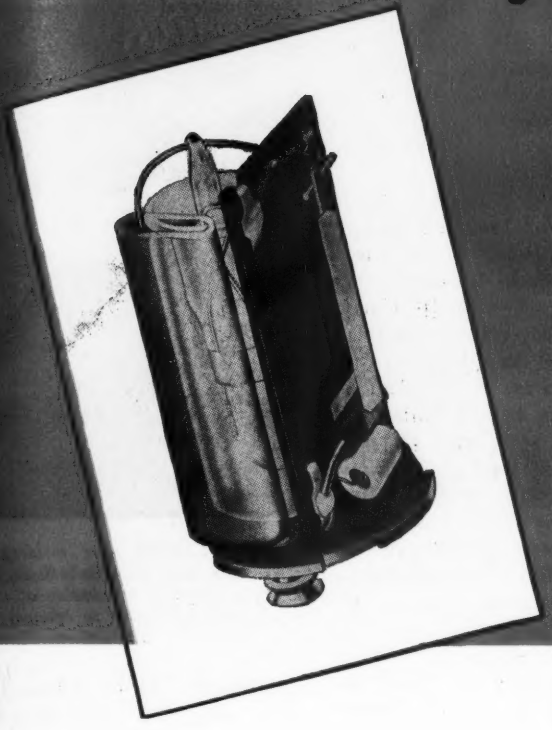
KATO MOTOR GENERATOR

Duo-Directional Sound Reproducer

This new model HI-8 duo-directional baffle reproducer can be used in conjunction with Executone's music and voice-paging systems. It is recommended for plant broadcasts of planned music. An eight-inch permanent magnetic speaker having a six ohm voice coil is enclosed in this acoustically designed baffle. An opening front and back provides duo-directional transmission. This baffle is equipped with a convenient internal mounting for a special transformer which matches the impedance of the reproducer unit to the wiring line and amplifier. Executone, Inc., 415 Lexington Avenue, New York 17, N. Y.

EXECUTONE REPRODUCER

Completely AUTOMATIC



BRYANT "NO-BLINK" STARTER

Automatically **LOCKS OUT A DE-ACTIVATED LAMP**

Automatically **RESUMES NORMAL OPERATION WHEN NEW LAMP IS INSTALLED**

Available in two sizes: FS4-NA for 40-watt lamps and FS6-NA for 100-watt lamps . . . Both are fully automatic in all their functions.

Saves lighting dollars—builds good will with users. **(1) Perfect starts lengthen lamp life. (2) Starters last longer because they do not wear themselves out in futile attempts to start de-activated lamps. (3) Ballasts are protected from overheating. Specify "No-Blink" starters for your fluorescent installations.**

Sold through electrical wholesalers.

ARMY (E) NAVY

THE BRYANT ELECTRIC COMPANY • BRIDGEPORT 2, CONNECTICUT

NEW YORK • SAN FRANCISCO • CHICAGO • LOS ANGELES

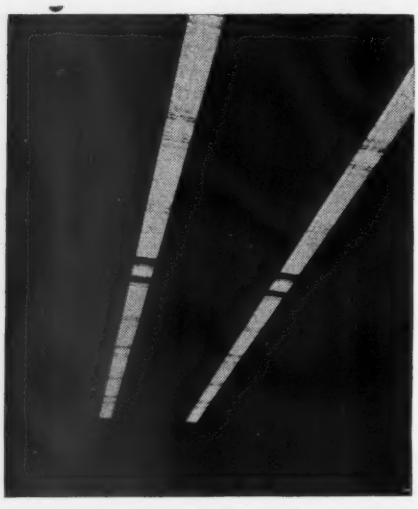
BRYANT
SUPERIOR WIRING DEVICES

MODERN LIGHTING

PLANT RECREATION LIGHTING

Industrial management is now recognizing the morale lifting effect of recreational facilities for its employees. Up in Milwaukee, Wis., the Allen-Bradley Company, manufacturers of electrical control equipment, is one example of progressive management that has long been fostering better employer-employee relations.

One illustration is Lynde Hall, a recreational center that Allen-Bradley employees can call their own. Here they can attend or participate in dramatics, hold socials and dances or take part in indoor sports. Scott Fitzhugh, Milwaukee, handled the architectural assignment and Magaw Electric Co., Milwaukee did the electrical installation.



***RECESSED TROFFERS** combine louvered fluorescent units with incandescent downlights to provide the high intensity general illumination.*

The lighting, which is tailored to the needs of the various recreational activities, is divided into three distinct systems—direct, indirect and stage illumination.

The direct lighting consists of 10 continuous rows of louvered fluorescent units in combination with five, 500-watt incandescent downlights per row. Each row contains 10 Curtis, two-lamp, five-feet fixtures with a downlight installed flush between each group of two fixtures. Recessed in the 20-ft. ceiling, this system bathes the 64-ft. by 100-ft. area with 60 foot-candles of illumination.

The indirect lighting system is used primarily for dramatic presentations. Mounted along each of the two side walls, approximately 10-ft. above the floor, are 18-ft. sections of cove completely equipped with Hub reflectors and 60-watt lamps on 9-inch centers. This is frequently used in conjunction with the stage lighting which includes footlights, border lights and the necessary spotlights.

The intensity of all incandescent and stage lighting units can be varied through Ward-Leonard motor operated remote control dimmers.

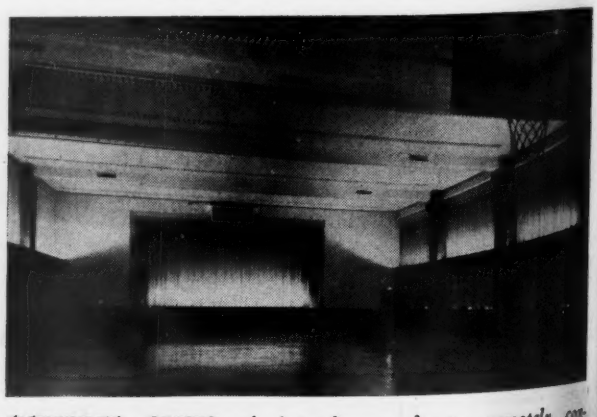
LIGHTING MAINTENANCE IN WELDING AREA

Smoke and fumes from arc welding equipment present a lighting maintenance problem which becomes more severe in the absence of ventilating equipment. In the Chas. T. Brandt, Inc., plant in Baltimore, Maryland, sheet metal sections are fabricated by arc welding. Almost the entire plant is devoted to welded fabrication. So much welding is done that each column in the plant is provided with at least one welding receptacle.

***REFLECTORS** over welding area are cleaned once each month to gain from six to eight foot-candles of light. Use of paint also adds to efficiency of lighting system.*

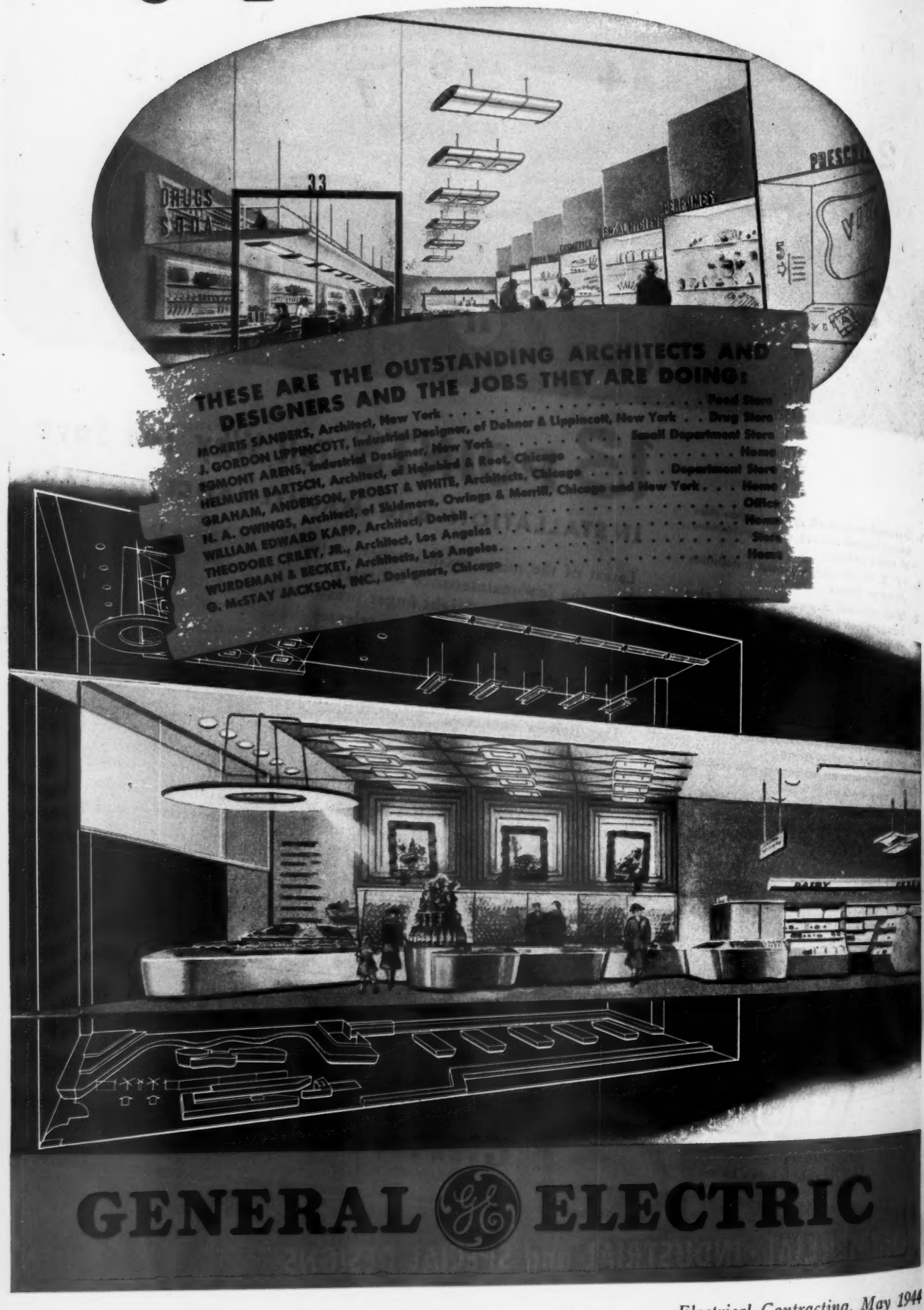
Since the fabricated sections are large and heavy, layout is generally done as welding proceeds and therefore plenty of light is necessary for the layout men. Twenty-four foot-candles of illumination is provided on the floor by an incandescent installation made by Central Electric Co., of Baltimore and consists of 1,500-watt bulbs in RLM dome reflectors. Units

***COMBINATION** fluorescent troffers and incandescent downlights provide 60 foot-candles of evenly distributed comfortable illumination for indoor sports in this recreational center.*



***INDIRECT COVES** of incandescent lamps, remotely controlled by motor operated dimmers, are used in combination with stage lighting for dramatic presentations and other social activities.*

G-E PAVES THE WAY FOR



POSTWAR LIGHTING PROGRESS!

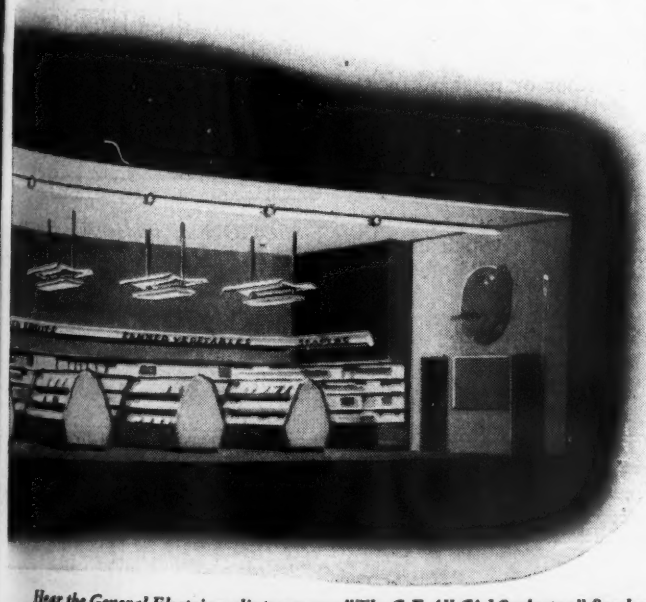
GENERAL ELECTRIC BRINGS TO THE LIGHTING INDUSTRY THE CREATIVE IDEAS OF FAMOUS ARCHITECTS AND DESIGNERS FOR BETTER COMMERCIAL AND RESIDENTIAL LIGHTING

THE postwar store, office and home offer the greatest opportunities for lighting progress in the history of the lighting industry. About 1,500,000 commercial establishments and some 600,000,000 sq. ft. of office space will be ready for better lighting; about 10,000,000 new homes will be needed to bring housing demand into balance with supply in the decade after the war.

To supply these markets with the kind of lighting that sets new standards of comfort and attraction will require development of new and improved lighting techniques. General Electric now offers the lighting industry a comprehensive program to stimulate this development.

G-E Enlists Outstanding Talent

Ten famous architects and designers have been retained by G-E to work out creative ideas for better lighting. Their assignments will cover small and medium-size stores, offices, and low and medium-price homes.



Their plans and suggestions will be made available:

1. To other architects, so that new lighting tools and techniques will become familiar to the entire architectural profession.

2. To fixture manufacturers, so that they may develop lighting units that are acceptable to architects and designers and at the same time efficient and easy to make.

3. To distributors, contractors and lighting companies.

4. To the potential buyers of better lighting, so they may have a wider appreciation of modern lighting practice.

To Promote Lighting Progress

We believe this new G-E program will help the lighting industry give the postwar buyer the benefit of the best planning, the best thinking, and the most effective lighting the industry can provide.

Suggestions for lighting the food store shown at left are described in a new booklet now ready. For your free copy, write Dept. 166EC-E, General Electric, Nela Park, Cleveland 12, Ohio.

A comprehensive G-E advertising program *will bring the work of these outstanding men to all interested groups. An advertisement featuring the food store, for example, appears in the April issues of Architectural Forum, Architectural Record, New Pencil Points, Chain Store Age (Adm.), Progressive Grocer, National Grocers Bulletin and Super Market Merchandising.*

Hear the General Electric radio programs: "The G-E All-Girl Orchestra," Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

THE BEST INVESTMENT IN THE WORLD IS IN THIS COUNTRY'S FUTURE—BUY WAR BONDS

"TO MAKE LAMPS STAY BRIGHTER LONGER"
The Creed of G-E LAMP RESEARCH

G-E MAZDA LAMPS

are mounted on 20-foot centers at a height of 28 feet above the floor.

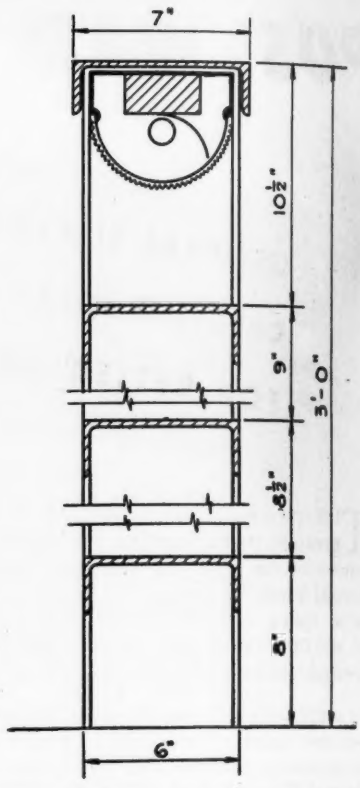
Plant engineer, E. J. Klaunberg has the ceiling and side walls painted egg-shell periodically, reflectors cleaned once a month, and bulbs replaced every 600 burning hours. From six to eight foot-candles of light are gained by monthly cleaning of reflectors. Much more additional light is gained at the working plane by the periodical painting. Increased efficiency of the lighting system is obtained by a group relamping operation.

FLUORESCENT BRIDGE LIGHTING

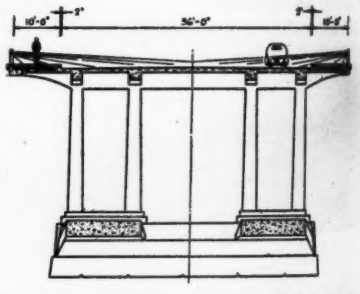
In an attempt to light the surface of a bridge without lighting standards and to keep the source of light below the level of the driver's eyes the bridge department of the California Division of Highways is trying out a novel plan for lighting the sidewalks and roadway by concealing the tubular light source under the bridge railing. The method, shown in the accompanying sketches, does away with lighting standards which are ordinarily extended from handrail posts on the bridge deck.

The lighting unit, employing the fluorescent or cold-cathode source, is mounted in the channel iron under the bridge railing. A reflector the length of the tubing directs the rays to the sidewalks and edges of the roadway. A semi-circular shield protects the light source from weather or mechanical damage.

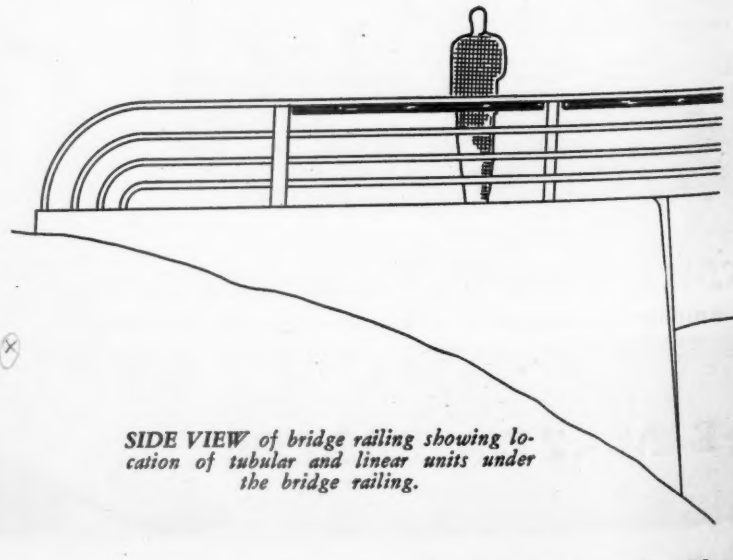
The California Division of Highways is doing considerable research work in the matter of highway illumination, bridge lighting, and lighting of directional signs and beacons which is coming of importance.



CROSS-SECTION of bridge railing indicating position of lamps, wiring channel reflector and enclosing glass of the lighting unit.



CROSS-SECTION of bridge showing the distribution of light from the lighting unit in the bridge railing on either side.



SIDE VIEW of bridge railing showing location of tubular and linear units under the bridge railing.

Neer INSTA-START Fluorescent Industrial

Instant-Positive Starting has No Starter Switches . . . Starts at 0° Temperature . . . Starts at Lower Voltages . . .

This new super-powered lighting unit operates standard 40 watt and 100 watt Fluorescent Lamps. Its insta-start ballast is made and guaranteed for a full year by a leading manufacturer of electrical transformers.

Insta-start units reduce maintenance by the elimination of starter switches. Turns on and off like an incandescent lighting fixture.

Will operate as low as 85 volts, which is important in plants where load capacities are a problem.

Insta-start units will operate at zero temperatures. Lamps will not blow-out in cold drafts.

Investigate this new Fluorescent Insta-start lighting unit today. Obtainable for immediate delivery.

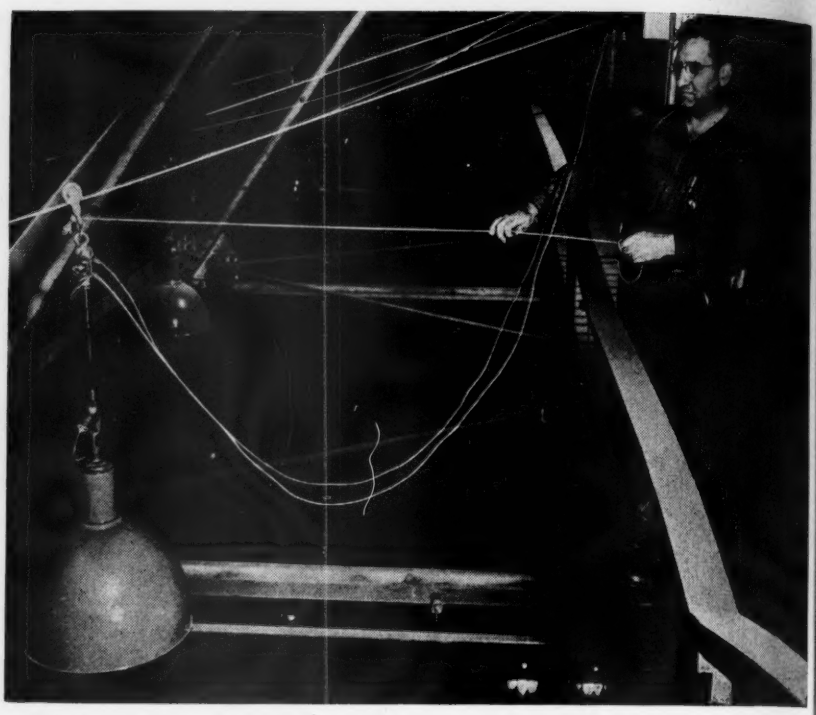
INSTA-START OUTSTANDING 50-A-SERIES FEATURE . . .

1. It's easier to install with this new rigid simplified construction.
2. Entire wireway and ends may be exposed quickly, without taking fixture down.
3. May be surface-chain or stem mounted singly or in continuous runs.
4. Exposed ballast gives longer life and cooler operation. Inverted under channel.
5. Special K.O. for pull switch is provided in lamp holder cover.
6. Complies with all W.P.B. and U. S. Bureau of Standard regulations.
7. Reflectors of masonite—formed and finished under exacting specifications in our own plant.
8. Underwriters' Laboratories approved equipment used in all these fixtures.
9. Union Made—International Brotherhood of Electrical Workers, A. F. of L. Bear their label.

Open and Closed Type Commercials

A new outstanding line of L. P. I. Commercials, ideally suited for drafting room, office or other essential locations, is now available with either Conventional or Insta-Start Ballasts. Write today for bulletins describing these new fixtures!

LIGHTING PRODUCTS INC. HIGHLAND PARK • ILLINOIS



HIGH-BAY FIXTURES are hung from an inclined steel messenger cable anchored at left in the building wall and at right to the vertical center support of the roof truss. Catwalk runs length of building and all fixtures can be pulled to it for maintenance.

FIXTURE SUSPENSION BY PULLEYS AND MESSENGER CABLE

A unique system of pulleys and messenger wire is used in high-bay fixture suspension at Westinghouse's East Pittsburgh plant, to speed maintenance of lighting equipment. Relamping and cleaning is carried out on a scheduled basis to maintain foot-candle levels in excess of a predetermined minimum value.

Steel messenger cable is installed at an inclined angle (between the building wall and center vertical support of the roof truss), down and away from the catwalk located at the center support and running the entire length of the building. As seen in the accompanying picture, an inverted pulley is used as a trolley. Rope cut to the proper length allows the pulley to ride down the messenger cable to its proper mounting location. For relamping and cleaning, maintenance personnel has merely to pull the fixture up to them while standing on the catwalk.

Open wires run from the pull boxes to the upper condulet (which is hooked to the pulley), down through the conduit and to the lower condulet which is provided with a single receptacle (for the fixture plug) and a hook to carry the fixture itself. Thus after the unit has been pulled over to the catwalk, it can be unhooked and unplugged permitting quick, safe and easy maintenance.

In the particular area in which the picture was taken, staggered 1000-watt incandescents and 400-watt mercury vapor lamps were spaced on 15 by 30-foot centers mounted about 65 feet above the floor.

INDUSTRIAL LIGHTING

Something of a record in the saving of critical materials for a job of its kind was achieved by Plant Engineer D. H. Palmer, of Ryan Aeronautical Co., San Diego, thinks Bruno Barth, San Diego Electric Co., who made the installation according to the former's plans at the new final assembly building there. The unusually large structure was constructed entirely of wood. In the same spirit of metals conservation, the wiring installation for lighting and power used the utmost minimum conceivable of steel and rubber.

Electrical requirements in the building call for high level illumination and accessible power for hand tools throughout the floor area. Handling of the lighting was especially ingenious.

Illumination is provided from twin 400-watt, 220-volt mercury lamps in Ivanhoe concentrating type reflectors, on 18-ft. centers throughout the large area, mounted 38 ft. from the floor. Maintained intensity is 45 foot-candles. The building roof is supported by exceedingly long timber trusses spanning the floor at that height without pillar support anywhere in the working area. This required the suspension of light-

[Continued on page 172]

PRACTICAL ARTICLES on the application, installation and maintenance of electronic apparatus in industry. Readers are invited to contribute items from their experience to this department. Articles used will be paid for.

ELECTRONICS

General Considerations in Installing and Maintaining Electronic Control

Explaining the important function of diagrams and meters in the handling, installation and maintenance of electronic equipment.

By H. L. PALMER

Electronic Section
Industrial Control Engineering Division
General Electric Company

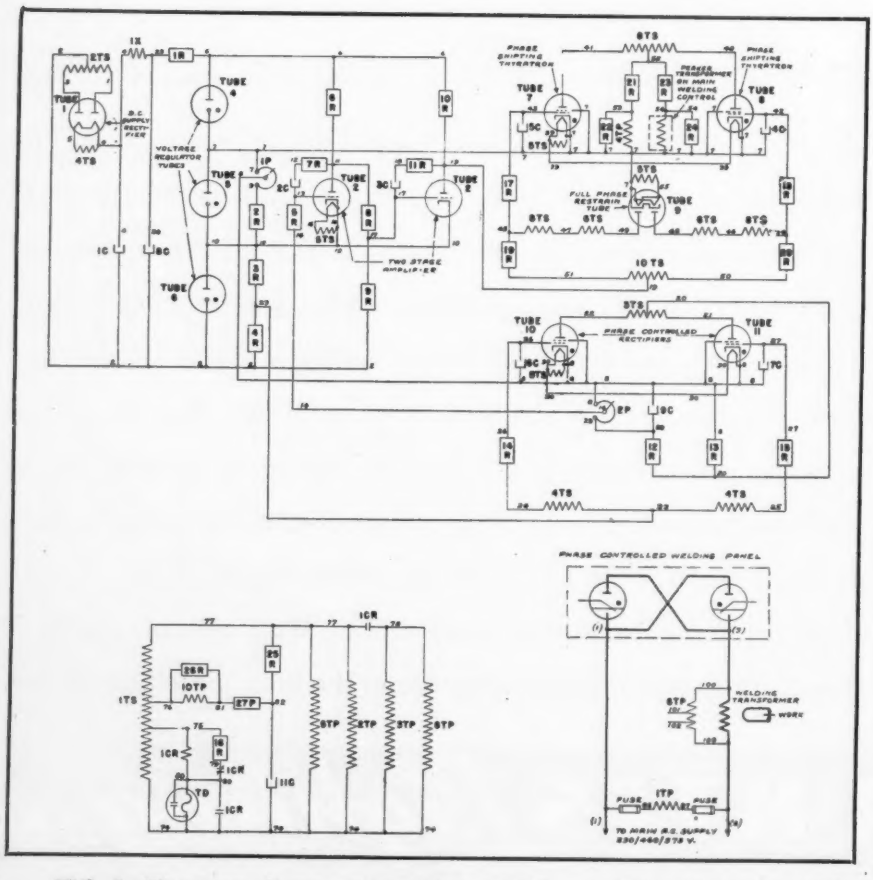
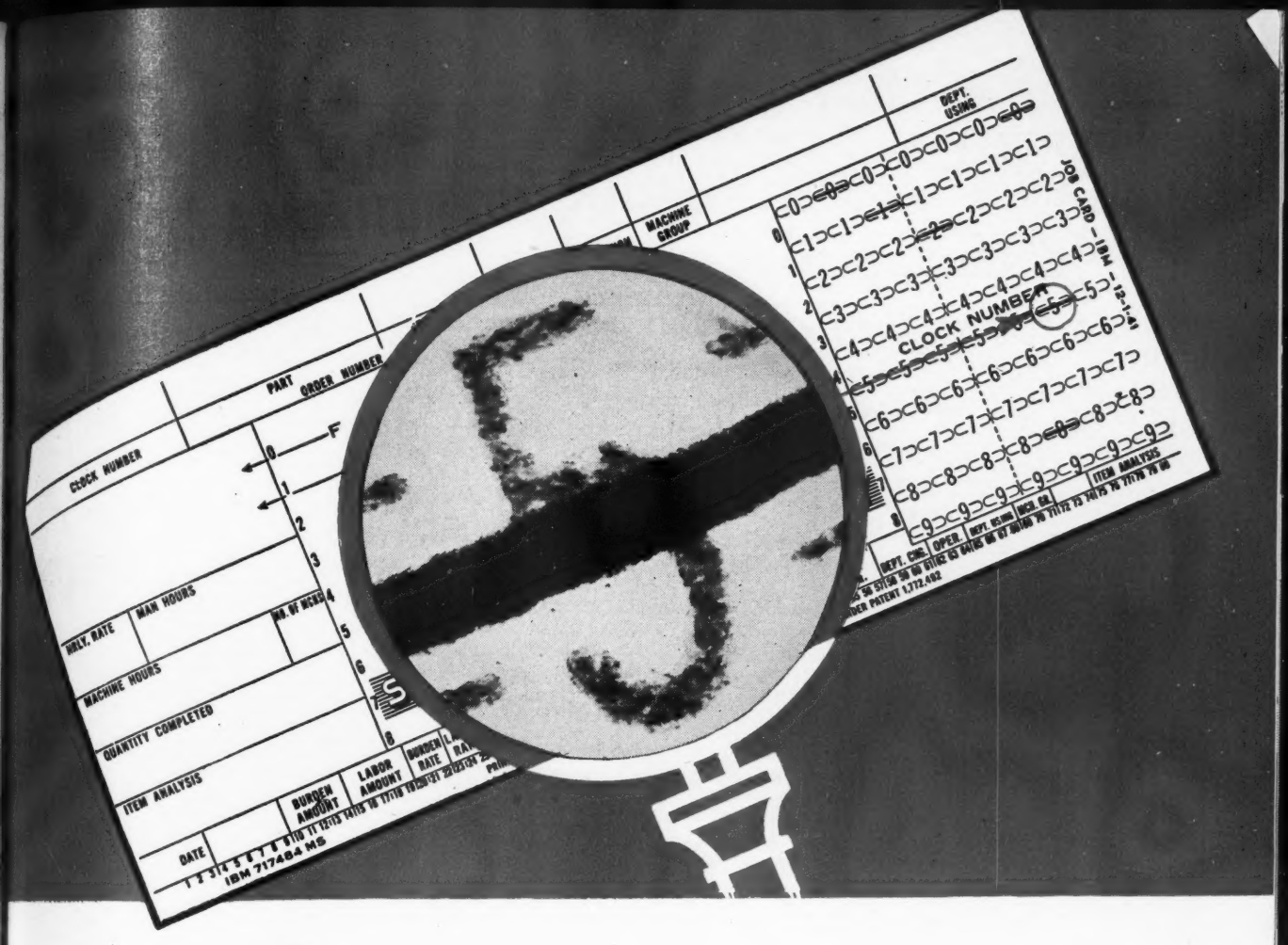


FIG. 1. Elementary diagram of a voltage regulator control with functional devices separated.

THE first consideration in installing or maintaining any electronic equipment is to become acquainted with the information supplied by the manufacturer. This information is supplied in two forms: 1, the diagram of connections; 2, the instruction book. The completeness of this information varies with the class of equipment. In general, the instruction books for established, general-purpose standard line panels are more complete than those for special purpose panels. Regardless of the completeness of the instruction book, all manufacturers supply complete detailed diagrams which usually give a tremendous amount of information if read carefully and understood.

Symbols

The information given on diagrams is often in symbolic form, requiring an understanding of the symbols used. The National Electrical Manufacturers Association and the American Standards Association have committees working continuously to establish unified symbols and all large manufacturers abide by the standards established for magnetic control. The picture, however, is slightly confused in the case of industrial electronic control,



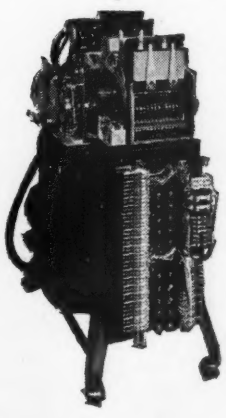
How an RCA  Electron Tube can "sense" a pencil mark

THE enlarged section shown above is a photomicrograph of a pencil-line drawn through the printed figure "5" on an INTERNATIONAL BUSINESS MACHINES accounting machine card.

A pencil mark such as this, being composed of particles of graphite, can be made to function as a conductor of electricity.

IBM has developed an ingenious electronic device in which this principle is used. Steel wire brushes, sweeping across the cards, pick up the tiny electric currents that are made to flow through the graphite pencil marks, and pass them along to a set of sensitive RCA electron tubes which amplify these very small currents so that they can be used to actuate the control relays of the card punching machine.

Compared to previous manual card punching operation, this electronic IBM "Mark Sensing Attachment" not only eliminates human errors at the key punch, but speeds up card preparation to a rate of 100 cards a minute.



International Business Machines "Mark Sensing Attachment" for IBM's Type 513 Automatic Reproducing Punch. Cover removed to show 20 RCA 25L6GT/G Beam power Amplifier tubes. On other side of machine are 10 more RCA tubes of the same type.

Probably right in your own plant, RCA electron tubes can perform some counting, sorting, control, measuring, or other function better, faster, more accurately, or more economically "the electronic way" than it is being done today. Why not write us so that we can refer you to the equipment manufacturer best fitted to solve your particular problem? Or our own tube engineers may be able to help you. *For the Magic Brain of all electronic equipment is a Tube... and the fountain-head of modern Tube development is RCA.*

Meantime, may we send you a free copy of "*Electrons in Action at RCA*," an illustrated, 32-page, practical booklet. Please write to RCA, Commercial Engineering Section, 628 South 5th Street, Harrison, New Jersey.

Buy More War Bonds

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION · CAMDEN, N. J.

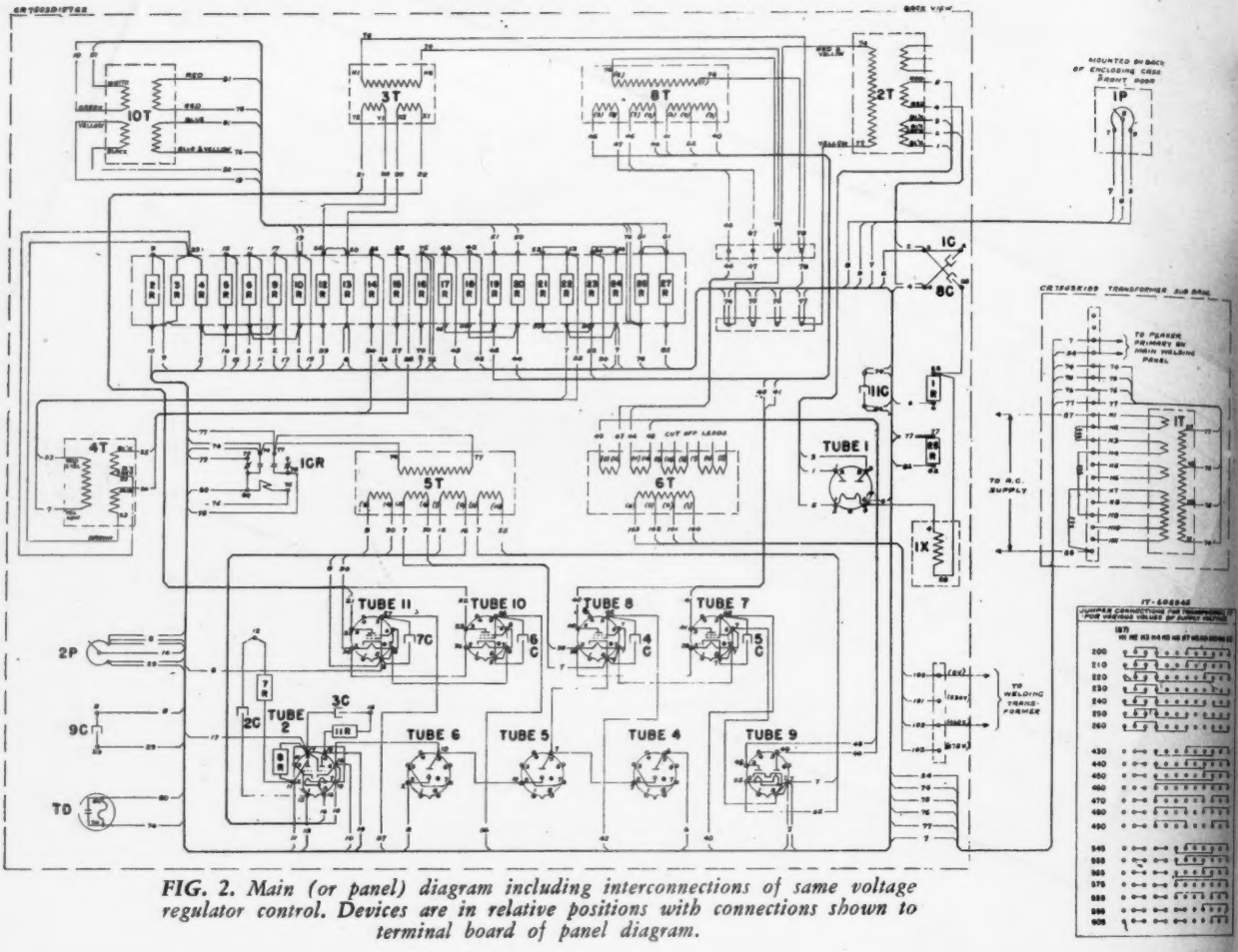


FIG. 2. Main (or panel) diagram including interconnections of same voltage regulator control. Devices are in relative positions with connections shown to terminal board of panel diagram.

largely because communication engineers have entered this field and brought with them some of the communication symbols that have not been common in the industrial and power field. Most large manufacturers use the industrial and power symbols when building equipment for this field whether it is electronic, magnetic, or a combination of both.

Because the electronic equipment in use today is built by a large variety of manufacturers, installation and maintenance men will encounter both types of symbols and should be familiar with them. The table on page 116 shows the symbols in common use today as well as several obsolete and newly proposed ones. It also includes the recently adopted ASA tube element symbols. These elements can be combined to represent any type of tube used in industrial apparatus today.

Diagrams

The wiring diagram, furnished with practically all equipment manufactured by firms acquainted with industrial requirements, has five subdivisions. These may be on five different pieces of paper or prints, or they may be all on one drawing. These subdivisions are:

1. Elementary diagram
2. Main diagram
3. Interconnection diagram
4. Material list and specifications
5. Installation and adjustment notes

The elementary diagram shows the parts and circuit elements as they are used in the circuit. Devices, such as relays, contactors, transformers, and switches that have functions in different circuits are separated, with individual parts located in that portion of the diagram where they are used. Each part of the same device has an identifying number and letter which indicates that all parts are on the same device. An example of this is shown in Fig. 1. Dotted lines are sometimes used to tie the parts of a single device together.

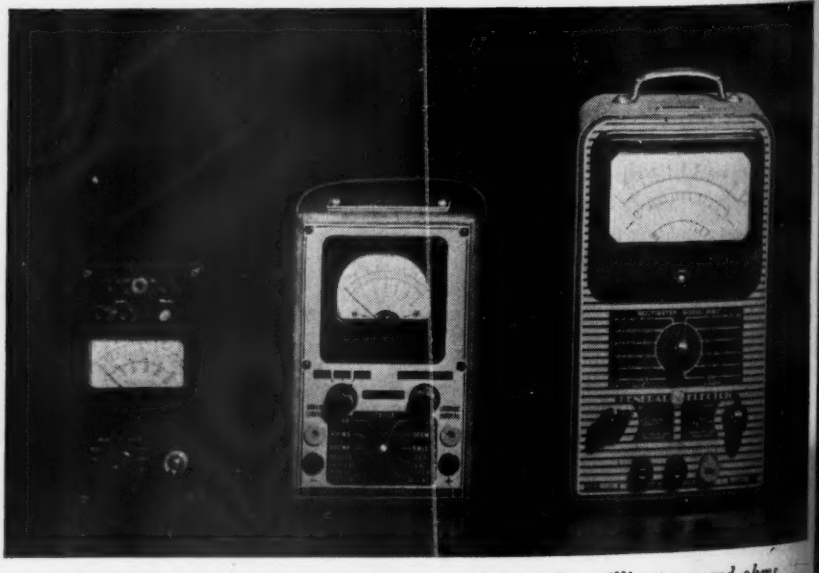


FIG. 3. Three multimeters for reading a.c. and d.c. volts, milliamperes and ohms. Left to right they are Triplett Electrical Instrument, Precision Apparatus, and General Electric.

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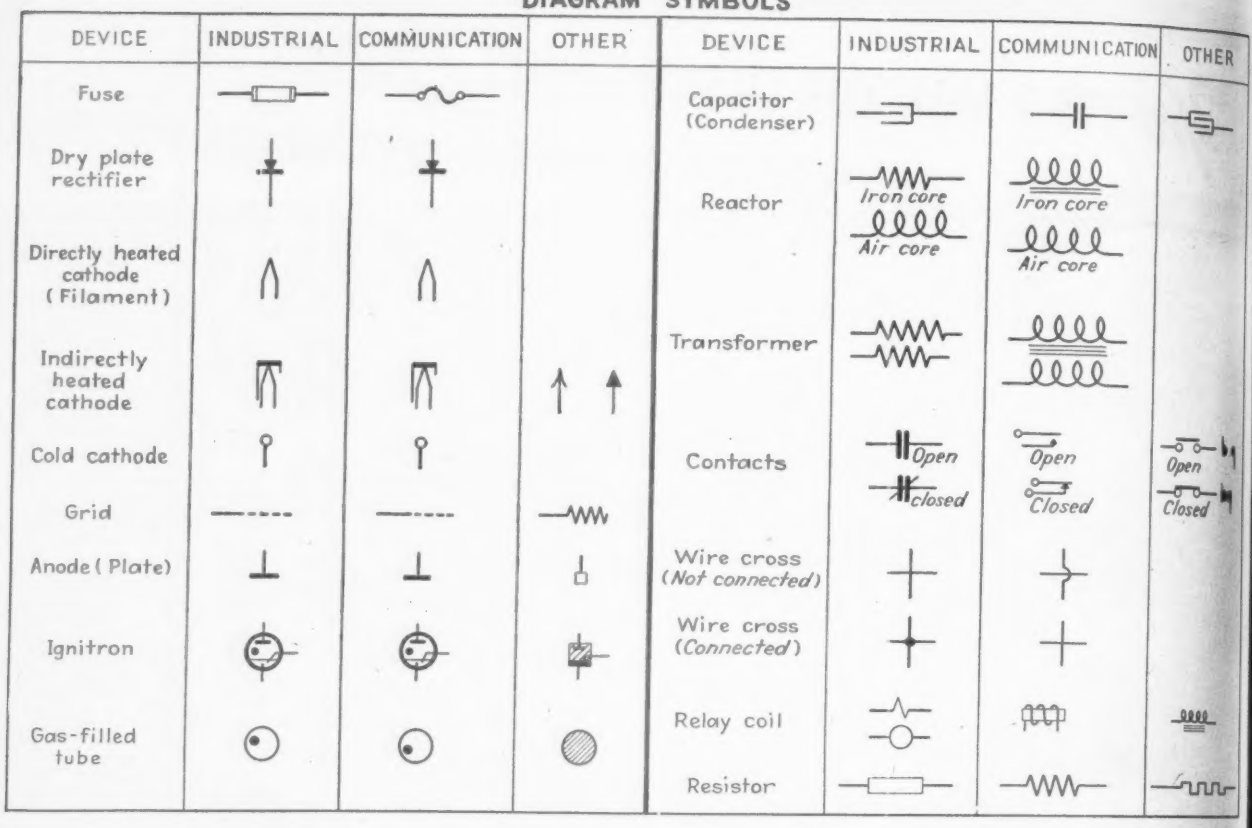

The elementary diagram is the one the engineer makes when he plans the equipment for a given job. It is also the one to be used by anyone else to figure out how the panel works. It should be referred to in trouble-shooting operations. With it, the sequence of operations can be traced, and by noting from the operation just where the failure occurs, the faulty relay contact or burned out winding can be located. In other words, if understood, this is the most useful diagram both before the equipment is built and after it is installed.

Panel Diagram

The main, or panel, diagram shows the relative physical location of the wiring on the panel. The relay coils and contacts are shown together and all the windings of a transformer are grouped as they are in the transformer. This diagram is made for the man building and wiring the panel. It shows him just where to mount the apparatus and where to run the wires. The terminal boards are shown in their relative location. The entire panel is shown in either back or front view and the top of the diagram is so labeled. The one exception to usual drafting practice is that the wires are never shown dotted whether they are on the viewed side or not. A dotted line means an optional connection and should always be accompanied with a note telling exactly under what conditions it should be used. The panel diagram has one other very important function and that is to help the maintenance man find the device or wire on the panel after he has determined from the elementary what change he should make. The device symbols and numbers, as well as the wiring point numbers, make this identification very simple.

The interconnecting diagram is produced for the installation man to show him just how to wire the control to the accessories and to the machine that is to be controlled. Many times the panels will be indicated as blank squares with only the terminal boards or outgoing connections shown. The engineer making this diagram must not only know about the control panel but he must also know the terminal markings on the machine to be controlled and all other parts of the system. When the system is simple the interconnections are often shown on the same drawing as the panel diagram. That is, the accessories and the machine to be controlled are shown connected to the terminal board of the panel diagram. Fig. 2 is such a diagram.

Many manufacturers include on the diagram a list of the parts, giving their specifications. This assists in checking the panel for defective apparatus and also serves as a parts list when ordering replacements. If the diagram is split up, this list will usually be on the elementary diagram.

Those things that cannot be shown by symbols on diagrams will usually be included as a series of notes covering such items as changes to be made when changing line voltage, and installation adjustments of a simple nature. Be sure to read every note on the diagram before starting the installation and then read and check them all again before applying power. For more complete information, see the instruction book supplied with the panel.

Meters and Test Equipment

The meters and test equipment required for installation and maintenance depend on several factors. These include the number of equipments involved, the type of equipment, and the importance of service continuity to the productivity of the plant. Here is a list that will cover practically all types of industrial electronic equipment and it is given in approximate order of importance.

1. *Multimeter or Analyser.* This instrument must read a.c. and d.c. volts with at least 5,000 ohms per volt. It should have facilities for reading resistance values approximately. A number of such meters (Fig. 3) are on

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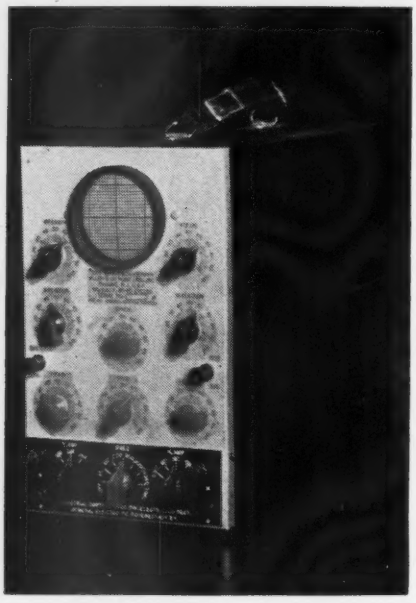

FIG. 4. Cathode-ray oscilloscope, built by DuMont Laboratories, has been modified to read d.c. voltages. The tube provides a three inch screen in this portable unit.

the market and range in price from $15 to more than $100 depending on ranges and accuracy provided.

2. *Cathode-ray Oscilloscope.* This should be portable, simple to operate, and modified (Fig. 4) to read d.c. voltages directly on the plates. A two- or three-inch tube is ideal for maintenance and trouble shooting. Oscilloscopes using a five-inch tube are useful in a laboratory, but are too heavy and large for use on the job. Several good models are on the market now but they must all be modified to read d.c. voltages. This modification is an absolute necessity for work on industrial electronic equipment. The cathode-ray oscilloscope is one of the most versatile and perhaps the least understood instrument available, and the next article in this series will be devoted to its theory of operation and use.

3. *Vacuum-Tube Voltmeter.* This instrument in its present commercial form (Fig. 5) will do better the same work done by the standard multimeter. It costs more and must be connected to a.c. power, which sometimes limits its usefulness and flexibility. On many low-energy and high-impedance circuits, it is the only instrument that can be used successfully.

4. *Split-core Current Transformer and Ammeter or Hook-on Meter.* Either the c-t and meter or the combined hook-on type of instrument is essential in checking the line current of resistance welding machines or other a.c. loads associated with electronic control. The instrument should be provided with a pointer stop so that current values of short duration can be measured.

5. *Single-element Magnetic Oscilloscope.* This instrument (Fig. 6) is ideal for reading accurately peak values of current even if only of half-cycle duration. It is also the best instrument for determining the balance, or magnitude of unbalance of a.c. transient currents.

6. *Radio Tube Checker.* This instrument is useful and worthwhile in large plants where considerable electronic control equipment is used. This is limited to radio receiver tubes and must be kept up to date to take care of new tubes as they are put out by the tube manufacturers.

7. *Industrial Tube Checker.* This is a tube tester for mercury and gas-filled tubes designed to measure the arc drop of the tube while passing short pulses of current (Fig. 7). The arc drop of a thyratron or phanotron is a measure of the cathode emission which is the expendable part of a thyratron or phanotron.

In general, electronic control apparatus is precision equipment and should be considered as such when it is being handled or stored. The tubes should be kept where the handling and possibility of damage will be at a minimum. To avoid condensation of moisture on the panels, they should be stored in a dry place where the change in temperature will be slight.

FIG. 5. Vacuum-tube voltmeter (built by RCA) which does the same job as a multimeter with better performance and accuracy. Reads a.c. and d.c. volts, and ohms.

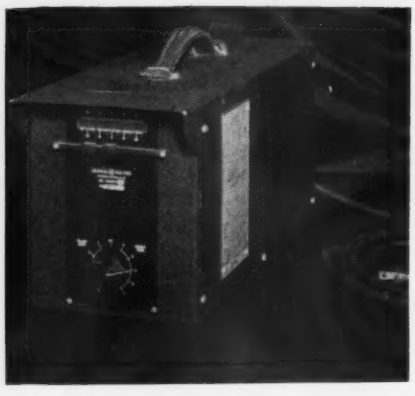

FIG. 6. Single-element magnetic-oscilloscope used for accurate measurement of peak currents of short duration.

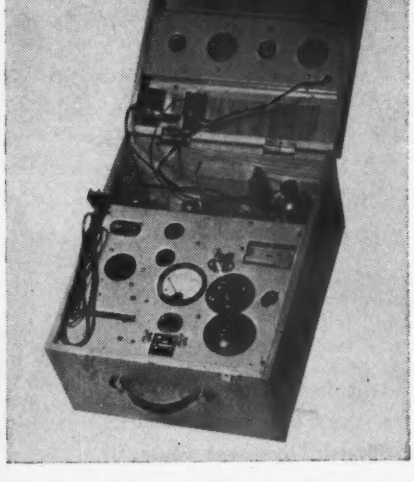

FIG. 7. Industrial tube tester for checking the performance of mercury and gas-filled tubes.

The moisture and dust laden air usually found around new buildings where concrete or plaster is being mixed and used, has been found to be disastrous to the high resistance circuits of electronic control panels.

Domestic packing methods are not weatherproof nor even weather-resistant. When the equipment is packed in excelsior it is protected from the direct action of the weather, but the excelsior acts as a sponge and keeps the equipment surrounded by moist air which will later be condensed on the panel with each heating and cooling cycle.

When the panels are unpacked ready for installation, they should be inspected immediately for broken or missing parts. Any shortages or defects should be reported immediately so that steps can be taken for replacement. The instructions and diagrams, after installation, should be kept in the files of the maintenance department where they are readily available when needed. Further, it is absolutely essential that diagrams be kept up to date. All replacements and substitutions of tubes, resistors, capacitors, etc., and circuit revisions should be noted on all drawings pertaining to specific equipment. Failure to do so may prove costly in emergencies.

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Electronic Auxiliaries—I

First of a series on the circuit elements of electronic apparatus. This article discusses resistors and condensers.

By RALPH B. IMMEL
Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pa.

While an electronic tube can perform wonders by itself, auxiliary devices are practically always required to work with the tube on most industrial applications. These range from resistors and transformers to rectox and relays; and an understanding of the basic characteristics of the following devices is essential to the best utilization of the tubes themselves.

1. Resistor

As the name implies, resistance is the opposition offered by a substance to the passage of an electric current through it. A resistor is a device which possesses the property of electrical resistance. Electrical energy can be converted into heat energy by the passage of a current through a resistor.

Resistors are a very essential part of an electronic device as they may function to limit currents or to vary the current or potential on a certain circuit or device. Resistors with a sliding tap connection are frequently employed as potentiometers to provide a very fine variation in the voltage.

As shown by Fig. 1, a typical resistor consists only of resistance wire and a heat resisting support. The resistance material that is used depends upon the magnitude of the resistance desired and the heat that must be dissipated. Carbon is the material often used in resistors for a very high resistance value and a relatively low heat energy dissipation. Strap or alloy ribbon, cast iron or alloy are often used for relatively low values of resistance and large current capacity. Resistors can be made in various forms to suit the particular application. Various types of adjustable resistors are known as rheostats, potentiometers, tapped resistors, or slide wire resistors.

The current flow through and the voltage drop across a resistor follows Ohm's law. The resistance of a substance in an electrical circuit can be computed by knowing the current passing through and the potential drop across it by the following formula:

$$R = \frac{E}{I} \text{ where}$$

R = resistance in ohms
E = potential drop in volts
I = current in amperes

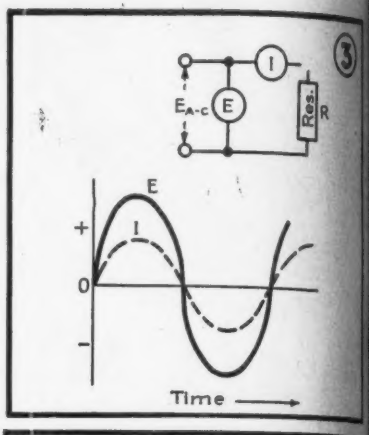
The volt-ampere characteristics of a typical non-inductive resistor on alternating or direct current as shown by Fig. 2.

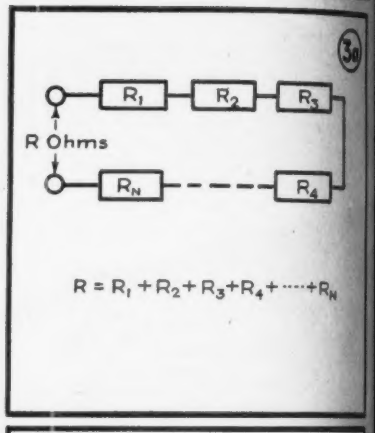
For special applications, resistors can be wound or constructed in such a manner that the magnetic effect produced by a current flowing through a resistor turn is completely neutralized. A resistor in which the magnetic fields are neutralized is commonly known as non-inductive. For low frequency applications and where the resistor inductance is relatively ineffective, the resistor operates equally as well on alternating current as on direct current. The current flowing through a non-inductive resistor in an alternating current circuit is in phase with the impressed voltage as shown by Fig. 3. The voltage and current are in phase as both have their maximum value and zero value at the same instant of time.

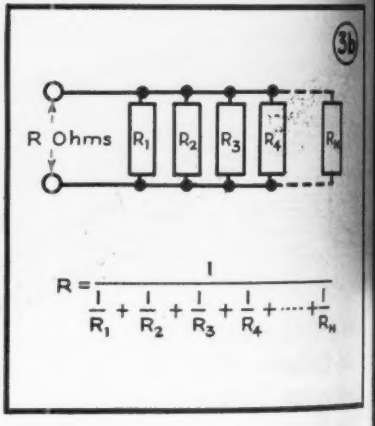
Resistors may be connected in series, parallel, or a combination of series-parallel. Fig. 3-a shows several resistors connected in series. As indicated by the formula, the total resistance is equal to the sum of the individual resistances.

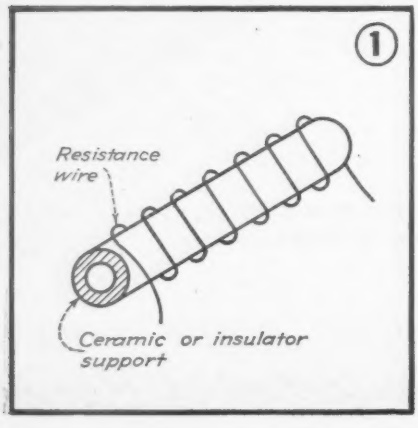
Fig. 3-b illustrates a parallel resistor connection. For this connection, the total resistance is always less than that of the smallest resistor and can be calculated by the formula given.

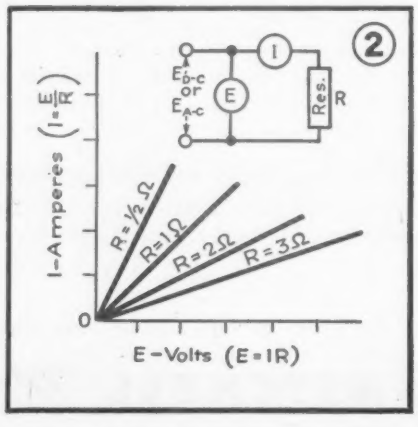
In the case of only two resistors con-











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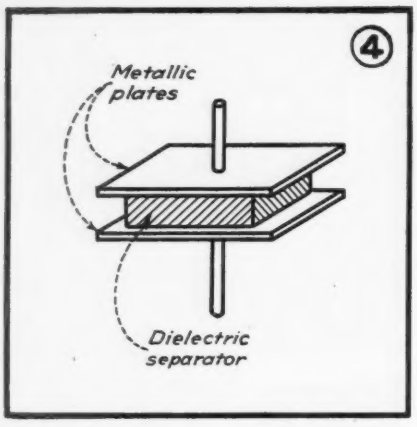


nected in parallel, the following formula which was derived from the general formula for the parallel connection is often convenient to use:

$$R = \frac{R_1 R_2}{R_1 + R_2}$$

2. Condenser — *(Capacitive Reactance)*

Whenever an insulator separates two conductors or metallic plates between which there is a difference of potential, an electrostatic capacity will exist between these two bodies. The assembly of two metallic plates or surfaces separated by an insulator to obtain capacitance is known as a capacitor or more commonly as a condenser. When a potential difference exists between two bodies, an electric charge will flow into them. This charging or displacement current will result in an electrostatic stress in the insulator. This stress in the dielectric represents stored electrical energy in the form of an electrostatic field. As shown by Fig. 4, the simplest form of a condenser consists of two metallic plates separated by a dielectric such as air, mica, glass, paper, porcelain, etc.

The capacity of this type of condenser is directly proportional to the area of the plate and dielectric employed, and inversely proportional to the distance between the plates.

The stored energy is directly proportional to the capacitance and the square of the impressed voltage on the plates. When a direct current potential is applied to the plates, a charging current will flow only until the plates are fully charged according to the following formula:

$Q = C\,E = I\,T$ where

Q = quantity of electricity in coulombs (1 coulomb = 1 ampere flowing for 1 second)

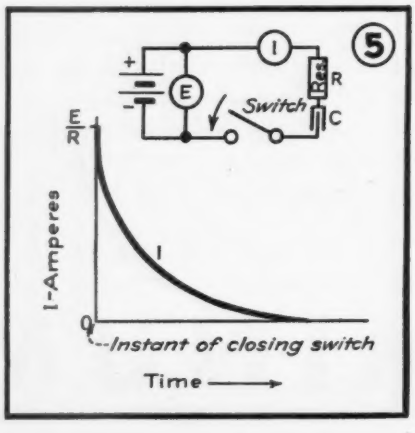
C = capacitance in farads

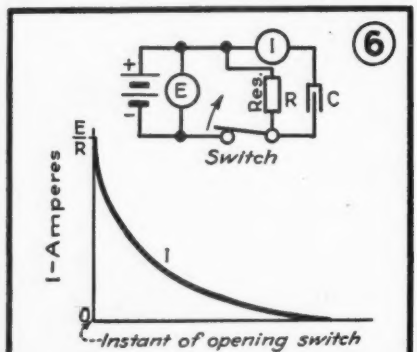
E = impressed voltage across the plates in volts

I = charging or discharging current in amperes

T = charging or discharging time in seconds

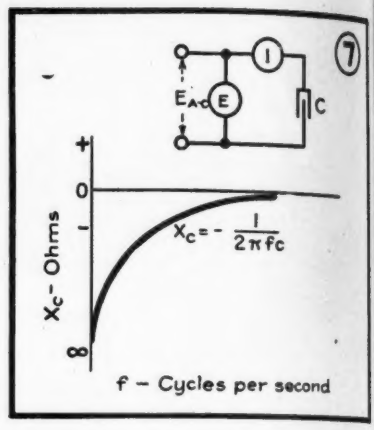
The time to charge or discharge a condenser can be controlled by varying the current by means of a resistor in series with the condenser. The transient current phenomena of charging a condenser is illustrated by Fig. 5. The condenser is fully charged when the current flow drops to zero. A charged condenser can be discharged by short-circuiting the plates or by allowing the charge to leak off slowly through a resistor. Fig. 6 shows the discharge current versus time for a condenser shorted by a resistor.





The time phenomena for charging or discharging a condenser is often used as the timing element in an electronic timer or oscillator. The voltage across the condenser during the charging or discharging period depends upon the time that the charging or discharging current has been flowing. A condenser is one of the few devices which is capable of storing electricity. The quality of a condenser is determined by its power factor which is also a measure of the dielectric properties and the ability of a condenser to retain an electric charge. A low power factor also means a low leakage.

When an alternating current potential is applied to a condenser, the condenser is rapidly charged and discharged as the voltage increases, decreases, and reverses in polarity. This continuous occurrence of charge and discharge constitutes an alternating current flow through the condenser. The energy that can be stored in a condenser for a given voltage is determined by its capacitance. The total amount of energy that can be stored in a condenser and subsequently returned to the circuit in a given period of time is greater when the condenser is charged a large number of times than when it is charged a small number of times in a given time period. The current flow will be larger when the stored energy is larger. The number of times that the condenser will be charged and discharged during a specific time period will be directly proportional to the frequency.



The capacitive reactance or impedance that a condenser offers to current flow in an alternating current circuit can be calculated by the following formula:

$$X_c = -\frac{1}{2\pi f C}$$ where

X_c = capacity reactance in ohms

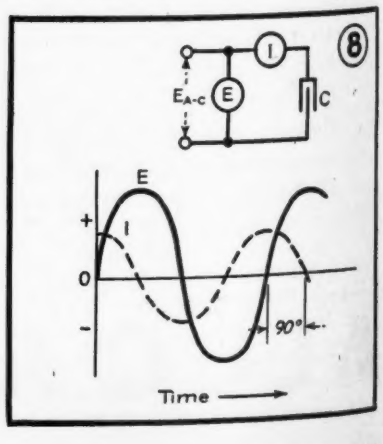
f = frequency in cycles per second

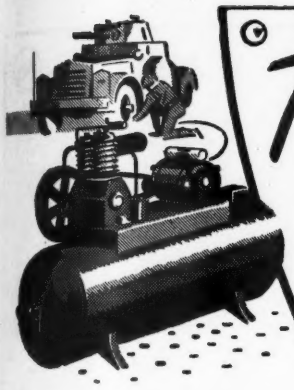
C = condenser capacitance in farads

$\pi = 3.1416$

The variation in condenser impedance with a change in frequency is shown by Fig. 7. The above formula has a minus sign and the impedance is plotted negatively as capacitive reactance is usually considered negative.

A condenser may be used in an alternating current circuit to change the phase angle between the current and





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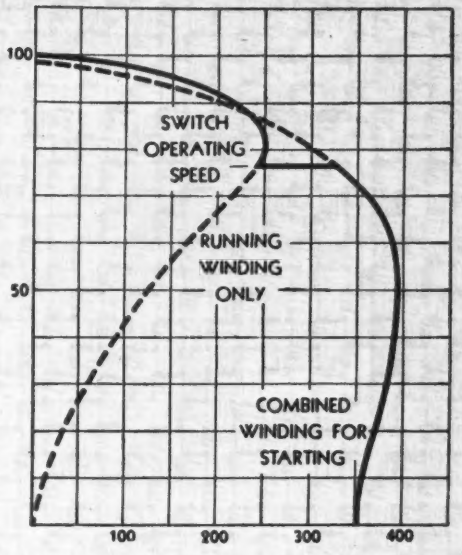

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50 cycles—2850, 1425, 960
25 cycles—1425

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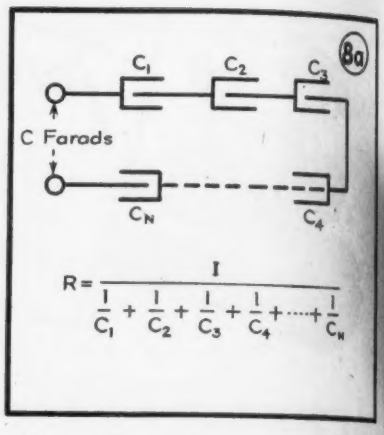


voltage. The current through a low-loss condenser leads the voltage by almost 90° as shown in Fig. 8.

As a condenser has a low impedance to high frequency alternating current, and a very high impedance to direct current, it is often employed in filter circuits and amplifier circuits to allow only the alternating current waves of certain frequency to be passed from one electronic circuit network to another.

In a purely capacity reactive circuit it is possible to have both high voltage and current without any power consumption as practically all of the stored energy is returned to the circuit.

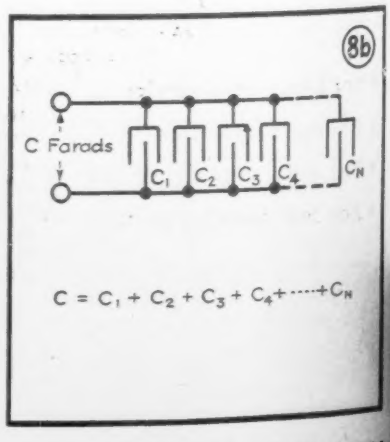
For condensers connected in series as shown by Fig. 8a, the total capacitance of the circuit is always less than that of the smallest condenser.

When two condensers are connected in series, the following formula often facilitates the capacitance calculation:

$$C = \frac{C_1 C_2}{C_1 + C_2}$$

Fig. 8b gives the formula for the total capacitance and shows the condensers connected in parallel. For condensers, the total capacitance of a parallel circuit is equal to the sum of the individual capacitances.

Note that this is just the reverse of the case of resistors. Refer back to the formulas for resistors and note that resistors in series are computed similarly to capacitors in parallel and resistors in parallel to capacitors in series.



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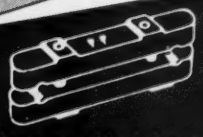
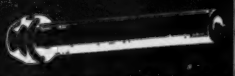


Cleats are ideal for open wiring in dry, damp, or wet locations.

Knobs may be used for either open or concealed wiring.



Tubes insure safety when a wire must be passed through timber or other combustible material.

• Quick installations are accomplished — economical results are realized — complete insulation and protection from the entrance switch to the very last outlet on the system — short-proof and shock-proof qualities of porcelain contribute to dependability—rust and corrosion resistance characteristics make porcelain the ideal material in damp, wet, or dry locations — porcelain gives you permanency and adequacy.

THERE never was a limitation placed on the use of porcelain . . . so therefore, with restrictions on rubber, steel and other critical materials wiring requirements throughout the nation have been and are being fully met.

The important thing about Porcelain Protected Wiring Systems is that jobs are made simpler to do and the most modern wiring is easily accomplished. In addition and an important point to the user is that Porcelain assures permanence.

Look upon Porcelain as not only an immediate answer to wiring but consider its great value for the post war period when extensive building programs will give you a most profitable opportunity and your customers the maximum in benefits.

★ **ILLINOIS ELECTRIC PORCELAIN CO.**
Macomb, Ill.

★ **PORCELAIN PRODUCTS, INCORPORATED**
Findlay, Ohio

★ **SPECIALTY PORCELAIN WORKS**
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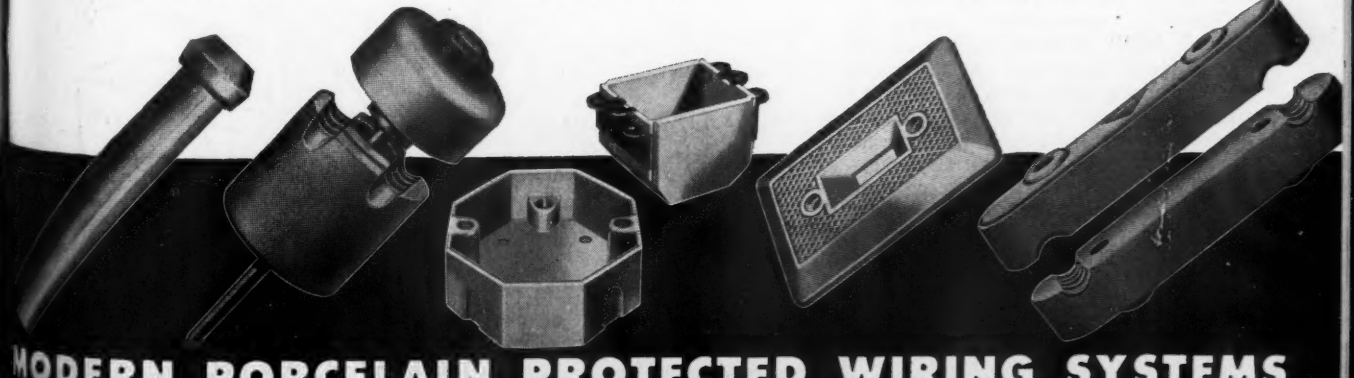
★ **SUPERIOR PORCELAIN COMPANY**
Parkersburg, W. Va.

★ **UNIVERSAL CLAY PRODUCTS COMPANY**
Sandusky, Ohio



MODERN PORCELAIN PROTECTED WIRING SYSTEMS

IN THE NEWS

NECA Launches Postwar Program

A four-point, over-all postwar program covering promotion, annual wages, apprenticeship training and reorganization of NECA was presented at a special meeting in St. Louis' Hotel Jefferson, April 15 and 16.

Desirous of gaining a head start on its postwar activities, the National Electrical Contractors Association called a special two day general meeting with 260 present to approve a comprehensive postwar plan recommended by the Labor-Management Planning Committee. Opening the session, President R. W. McChesney reviewed the progress made with governmental agencies on industry problems. He cited the recent renegotiation act exemptions of aggregate contracts less than $5,000 after June 30, 1943 and competitive bid construction contracts as examples. He concluded by citing the need for the proposed postwar program discussed later.

The business promotion phase of the program embodies a national and local technical and business press advertising campaign designed to reach the industrial maintenance and repair markets. Walter Funnel and Frank C. Peterson, Bridgman Sanger Agency, New York, illustrated the proposed campaign which was referred to the chapters for final ratification.

The second phase of the plans concern the annual employment of electrical workers. Sensing an economic and stabilizing need for an annual wage plan, E. J. Brown, president, IBEW, singled out the maintenance and home wiring fields as the logical starting points and asked the cooperation of NECA chapters in promoting it. The construction field would be next. Mr. Brown asked for immediate action on sound postwar plans.

Discussing reconversion, Joseph D. Keenan, WPB, Washington, pointed out that industry must have quick payment for work done under cancelled contracts and positive steps must be taken now to prevent privation during any temporary reconversion period of unemployment. On this program of national scope, individual plans cannot take care of everyone, hence the need for congressional action, he concluded.

M. H. Hedges, Labor-Management Planning Committee, Washington, reviewing the war advances of the electrical industry, suggested the application of the same engineering standards and techniques to the integration of the electrical industry on an open-handed basis. A committee with all branches of the industry, including labor, represented should discuss industry problems and clear away obstacles to such an integration program, he added.

The third phase is apprenticeship training. Reporting on the activities of the National Joint Committee on Apprenticeship Training, Chairman E. H. Herzberg, Milwaukee, presented a program to promulgate standards for the entire electrical industry. Included are construction, electronics, line construction, motor winding and repair, industrial and commercial maintenance and educational standards for advanced journeymen. Stressing postwar period industry training, Wm. F. Patterson, Director, Apprentice Training Service, WMC, Washington, commended the electrical construction industry for their present and future program.

The final conference session covered the reorganization of NECA. Basing national strength on strong local chapters, the governing body submitted proposals, which were approved, giving the chapters direct voice in organization policies. Briefly, these constitutional amendments

"Let's run this conduit around the long way so we can be together longer!"

THE CUSTOMER BOUGHT THIS ROLL OF TAPE IN 1917 . . .

. . . What remains on the core is still good!

The small section of Manson Friction Tape left on the 25-year old roll was sent to the laboratory for test. Here's their report:

"This is the oldest roll of Manson Tape . . . or any friction tape . . . which we have ever examined. This tape still has sufficient adhesion quality to stick and stay put when wrapped as on a joint or splice. There was insufficient tape remaining to conduct all tests. We did, however, make several tests given in ASTM Spec. for Friction Tape D69-28.

"The tensile strength showed 51.2 pounds and 49.3 pounds per inch of width compared with ASTM specified minimum value of 40 pounds per inch of width.

"The tape withstood the ASTM dielectric strength test of 1000 volts without breakdown."

UNTIL MANSON TAPE IS AGAIN AVAILABLE

The manufacture of Manson Tape which requires a special type of new rubber has been temporarily discontinued since all new rubber has been forbidden for this use. Until Manson Tape is again available we recommend as alternative our Dundee A friction tape or Panther and Dragon friction tapes which are carried in stock by most independent wholesalers. Each of these brands complies with current Federal and ASTM emergency specifications.

Tape users know that ordinary friction tapes are so badly deteriorated after five years that they are entirely unsuitable for use. That's why so many electricians and maintenance men always specify "Manson". They know it lasts.

**Name upon request.*

THE OKONITE COMPANY

PASSAIC OKONITE NEW JERSEY

MANUFACTURERS OF INSULATED WIRES, CABLES AND TAPES SINCE 1878

provide for a board of governors comprising an elected member from each chapter with national officers members ex officio; the redivision of the United States into six major divisions each with a vice-president; an administrative committee, composed of the president, six vice-presidents and chairman of each special benefit activity committee, to execute the policies of the board.

N.C.E.I. STUDIES POSTWAR REPORTS

Presenting a picture of unified cooperative effort that is unique, 589 representatives of all branches of the electrical industry in Minnesota and boundary states attended a two-day War Conference, March 27-28 at the Hotel St. Paul, St. Paul, Minnesota. Sponsored by 12 electrical trade groups and coordinated through the North Central Electrical Industries, the conference stimulated some of the best thinking on the industry's present and postwar issues.

The conference followed closely last year's pattern of individual group business sessions and all-industry meetings where subjects of common interest were discussed. The first all-industry evening session was devoted to a review of reconversion and the postwar appliance market. L. E. Moffat, editor, *Electrical Merchandising*, in analyzing the overall appliance market warned that the postwar appliance will be higher priced than the prewar models, but that such prices, in general, will be moderate compared to the general price picture. The appliance dealer has learned one lesson from the war—that service departments can be operated without loss and be made to produce profit, he continued. An open forum discussion followed with experts from all branches of the appliance distribution field answering all questions.

A second all-industry session sponsored by the Minnesota Electrical Inspectors Association and the newly organized Rural Electric Equipment Council, was devoted to adequacy of electric service and the use of electricity on the farm. Norton Ives, agricultural engineer, University of Minnesota, stated that expansion of electrified farms depends upon the development of equipment designed specifically for farm use—at a price the farmer can afford. Application of electricity to farm production tasks must show a profit to the farmer if he is to be sold on it, he concluded.

Speaking from actual experience, Wm. A. Benitt, a farmer who operates a 200 acre electrified farm, summed up the farmers' electrical needs as: (1) continuous electrical service; (2) proper electrical equipment; (3) adequate equipment service facilities; and (4) adequate electrical wiring. Safe wiring is simply good accident insurance, he continued, but electrical re-inspection will fail unless the farmer is given a clearer picture of the function of electrical inspection. W. H. Kircher, The Farmer, St. Paul, concluded the session with a review of the farm market for electrical equipment.

A third all-industry meeting was devoted entirely to postwar planning. The future of small business, warned Dr. W. F. Kissick, regional business consultant, U. S. Department of Commerce, lies in cooperation, adjustment to postwar conditions, rendering a better service than your competitor and the reduction of distribution costs. The very survival of small business may well depend upon active interest in your trade association, he concluded.

The home building fraternity is the most important group in today's postwar planning, stated A. E. Schanuel, National Adequate Wiring Bureau, in presenting the electrical picture in the postwar home. Although all home electrical conveniences may not be immediately available after the war—construction materials will, therefore adequate wiring should be installed now for such appliances and conveniences when available, he warned.

One of the high spots of this session was the presentation of a detailed postwar planning report by L. G. Mample, chairman, Central Planning Committee, N.C.E.I. This 17-page document, representing months of work by five sub-committees, presented detailed recommendations of the contractor-dealer group, commercial utilities, electrical wholesalers and distributors and manufacturers. By analyzing past mistakes and present and future problems, the report signifies a broad step in the direction of a better organized, more cooperative electrical industry for the future. Basic programs will be built around these recommendations.

ED TAKES OVER—Before retiring president Don Kehne (left) St. Paul, adjourned annual meeting of the Minnesota Electrical Council, Ed Raetz of Rochester (center), newly elected president takes over reins. Secretary-manager W. A. Ritt beams approval.

Although scheduled primarily for solution of existing problems, the local group business sessions were permeated by the thread of postwar thinking. Contractor-dealers topped group registrations with 188 members present at the annual meeting of the Minnesota Electrical Council, Inc. Sam Newstone, Montevideo contractor and chairman of the Chippewa County Selective Service Board narrated the unglamorous job of Board members and gave little hope for deferment of men under 26. The heat is really on this group, he concluded. The how, why and wherefore of OPA price regulations Nos. 165 and 251 were clarified by C. L. Davis of the District OPA who answered questions of all comers.

Analyzing the major immediate postwar markets, W. T. Stuart, editor, *Electrical Contracting*, predicted an eye-opening grand total of $16,238,000,000 which would produce approximately $1,328,000,000 of electrical work, based on the assumptions that there will be a final armistice before the middle of 1945 with no chaotic postwar price inflation. The electrical construction industry, packed with the "know-how" of a war job well done is ready and willing to accept broader responsibilities in the postwar future, he concluded.

Recognizing the urgent need of surplus materials for civilian needs and services, the Council went on record by resolution to appeal to the Truman Committee of the U. S. Congress and the other appropriate governmental agencies, to investigate the total surplus materials now available and promptly divert any such material not needed for war purposes on or off the site into trade channels for disposition to meet civilian needs.

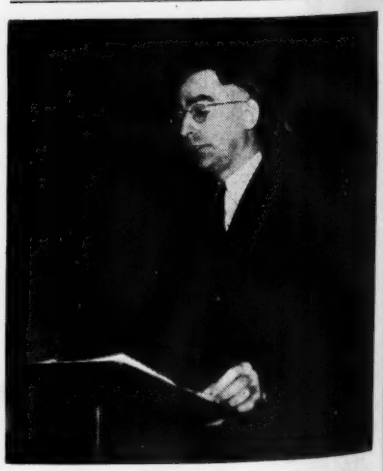
COMFORTABLE QUARTET—After a hectic business session at recent N.C.E.I. War Conference in St. Paul, Minnesota contractors (L. to R.) C. S. Williams, Minneapolis; J. W. Hruska, Mankato; F. M. Tripp, Minneapolis; and C. P. Meyers, Melrose, relax in the depths of a lobby davenport.

Officers of the Minnesota Electrical Council, Inc., elected at the Board of Directors meeting include: president, Ed Raetz, Rochester; vice president, Wm. Lindberg, St. Paul; treasurer, F. M. Tripp, Minneapolis; and secretary, W. A. Ritt, St. Peter. New directors-at-large include: L. E. Schaffer, Pinestone; Ed Karst, Fergus Falls; Lou Gordon, Albert Lea; J. W. Hruska, Mankato; Ed Raetz, Rochester and Chas. Wood, Fargo, N. D.

At the business session of the Minnesota Electrical Association (contractors and dealers outside the Twin Cities) the problem of farm wiring inspection fees received considerable attention. A resolution designed to modify inspection fees and the filing of affidavits in specific cases was referred to a committee for further action. A similar resolution received similar action at the meeting of the Minnesota Electrical Inspectors Association. New officers elected include: president, Ed Linner, Stillwater; vice president, M. A. Oien, Cloquet; and secretary, W. A. Ritt, St. Peter. Executive committeemen are E. L. Peterson, St. James; John Engle, Rochester; G. L. Haugland, Appleton. Executive directors to the Minnesota Electrical Council, Inc. are W. A. Ritt, St. Peter; Sam Newstone, Montevideo, John Ellenbecker, St. Cloud; Ed Micka, Hibbing; and Eric Nylund, Duluth.

The Minnesota Electrical Association presented F. M. (Jerry) Tripp, Minneapolis contractor, with an honorary membership in honor of his many years of work in association activities and in the electrical industry. The presentation was made at the Conference Dinner meeting by president Eric Nylund of Duluth.

The Minnesota Electrical Inspectors Association, at their business session, discussed at length the problem of farmers making home made electrical equipment such as brooders, etc., and doing their own wiring. The members agreed on the need for more supervision and education on electrical safety in the construction of home made equipment, now encouraged by REA. To this end a Legislative Committee will be appointed to study proposals for a statewide inspection of rural areas.



***SMALL BUSINESS** can approach postwar era with confidence if it plans now, says Dr. W. F. Kissick, regional consultant, U. S. Dept. of Commerce, as he addresses the N.C.E.I. Postwar Planning Clinic at recent St. Paul War Conference.*

Martin Streed, chief electrical inspector, Minneapolis, was elected president of this group with Robert Kaping, REA inspector of Litchfield, vice president Glenn Rowell, Minneapolis, was re-elected secretary-treasurer.

Oscar M. Frykman, retired chief electrical inspector of Minneapolis, was elected a life member of the Minnesota Electrical Inspectors Association in recognition of his services in the field of electrical inspection and safety.

EMERGENCY COMMITTEE OF ELECTRICAL COMMITTEE N.F.P.A. MEETS

The Emergency Committee of the Electrical Committee, N.F.P.A., held its sixth meeting in New York City on March 15th.

Due to war conditions, no supplement to the Code will be printed. The changes are:

INTERIM AMENDMENT NO. 74, Approved September 10, 1942.

Table of Note following paragraph (c) of section 2203 (Interim Amendment No. 74 approved September 10, 1942). Change last two items of table to read;

"6 to 40 ranges.....20,000 watts plus 1,000 watts for each range over 5
"41 ranges and over.....55,000 watts plus 750 watts for each range over 40."

INTERIM AMENDMENT NO. 69, Withdrawn

This amendment is a note added to section 3005 of the 1940 National Electrical Code, as approved August 4, 1942, and revised September 10, 1942.

Delete the note, thereby withdrawing the recognition of conductors with emergency insulation (Type EI) when used as ungrounded conductors. Withdrawal includes the recognition of conductors with this emergency insulation with lead-covering, Type EIL.

INTERIM AMENDMENT NO. 85

Amend paragraph (a) of section 4503 by substituting the following for the entire present text of the paragraph in the 1940 Code.

a. *Dry-Type Transformers*—Dry-type transformers shall conform to the following:

1. *Minimum Space Separation*—An air space of not less than 6 in. shall be pro-

***THE TOUGH JOB** that faces draft boards is told Minnesota electrical contractors by Sam Newstone, Montevideo contractor and chairman of Chippewa County Selective Service Board.*

Designed ENGINEERED MANUFACTURED

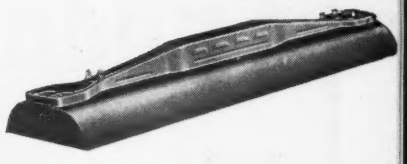
Accepted by the trade and specified by leading architects as paramount in the field of fluorescent light fixtures; Leader Units have been installed in ever increasing quantities throughout America's industrial and commercial organization.

The Leader Electric Mfg. Corp. is known nationally for high standards of quality and workmanship. More important Leader straight-line merchandising methods assure jobber and dealer profits, in this, the fastest growing division of the electrical industry.

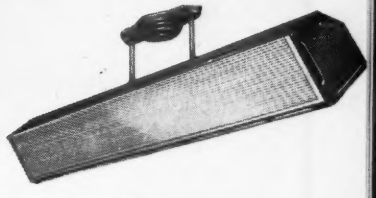
Your inquiry will receive the prompt attention of Leader Engineers.

BY Leader

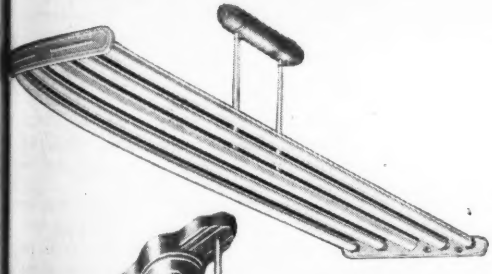
ZUO Series:
Sturdy, streamlined industrial unit available in two and three light 4' watt units and two light 100 wat units. Designed for individual o continuous run installation.



ZIU Series:
Industrial units for concentrate and complex lighting installation available in two and three light 4' watt units and two light 100 wa units. Designed for individual o continuous run mounting.

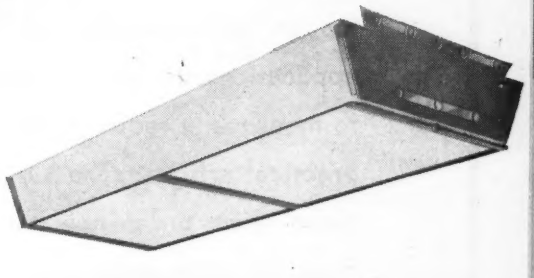


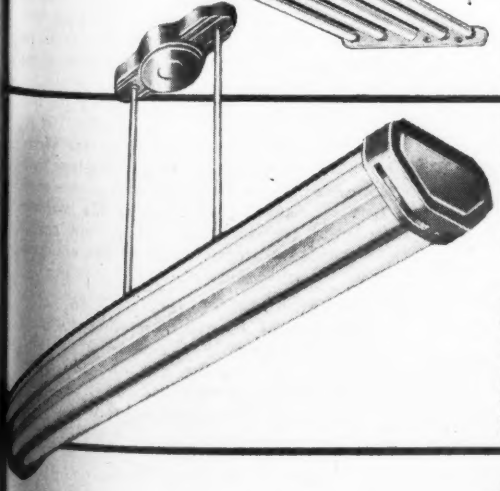
GL-240:
Two light 40 watt, glass enclosed louvred unit, unusually efficien designed for pendant or ceiling su pension mounting, constructed fo individual or continuous run insta lation.



VO-440:
Four light 40 watt, parallel tube, open type luminaire. Remarkably simple to install, maintain, and service. Available for pendant or ceiling suspension mounting, continuous run or individual installation.

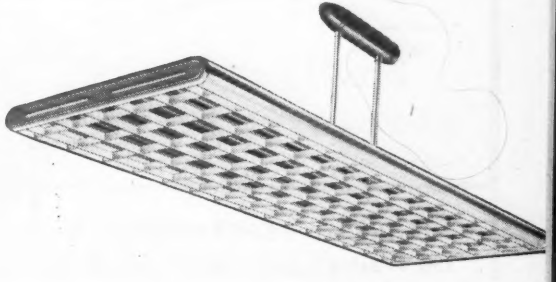
LR-440:
Four light 40 watt, glass enclosed unit, manufactured in accordance with the Utilities Research Commission specifications. Available for pendant or ceiling suspension mounting, individual or continuous run mounting.





L-440:
Four light 40 watt, parabolic, open type unit, specifically suited for drafting rooms and war production offices where general overall light is required. Available for pendant or ceiling suspension mounting, continuous run or individual installation.

VL-440:
The LEADER OFFICER—Four light 40 watt plastic enclosed, louvred unit, combining the finest in design, construction, and servicing feature, this unit offers the ultimate in present day lighting equipment. Available for pendant or ceiling suspension mounting, individual or continuous run installation.



Leader

ELECTRIC MANUFACTURING CORPORATION

6127 NORTH BROADWAY CHICAGO 40, ILLINOIS

CORRIDOR STORY told by George E. Prekker, (left), Clara City, Minn., electrical contractor, draws chuckles from M. M. Larson, Sacred Heart contractor at recent N.C.E.I. meeting in St. Paul.

vided between transformers and between each transformer and adjacent surfaces other than the surface upon which the transformer is mounted.

2. *Units of 100 Kva. or Less*—Units of 100 kva. or less shall have a separation of at least 12 in. from combustible material unless separated therefrom by a barrier of noncombustible, heat-insulating material, or unless of a rating of 600 volts or less and completely enclosed except for ventilating openings.

3. *Units Over 100 Kva.*—Units of over 100 kva. shall be installed in a transformer room of fire-resistive construction unless they are constructed with Class B insulation as defined in AIEE standards and are separated from combustible material not less than 6 feet horizontally and 12 feet vertically. These space separations may be reduced by the use of an effective barrier of noncombustible, heat-insulating material.

Section 4551—Add the following sentence to the present text:

Section 4551—Amend by adding the following sentence at the end of the section. "If of the dry-type and insulated with Class B insulation, the class of insulation shall be indicated on the name plate."

Section 4552—Amend by substituting the term "Dry-type" instead of air-cooled transformers as the caption and substitute the following for the second sentence of the present text.

Section 4552—Amend by using the term "Dry-type" instead of "air-cooled" in the caption and text, and replace the second sentence with the following: "Dry-type transformers shall be provided with a case or enclosure made of noncombustible moisture-resistant material and which will provide reasonable protection against the accidental insertion of foreign objects."

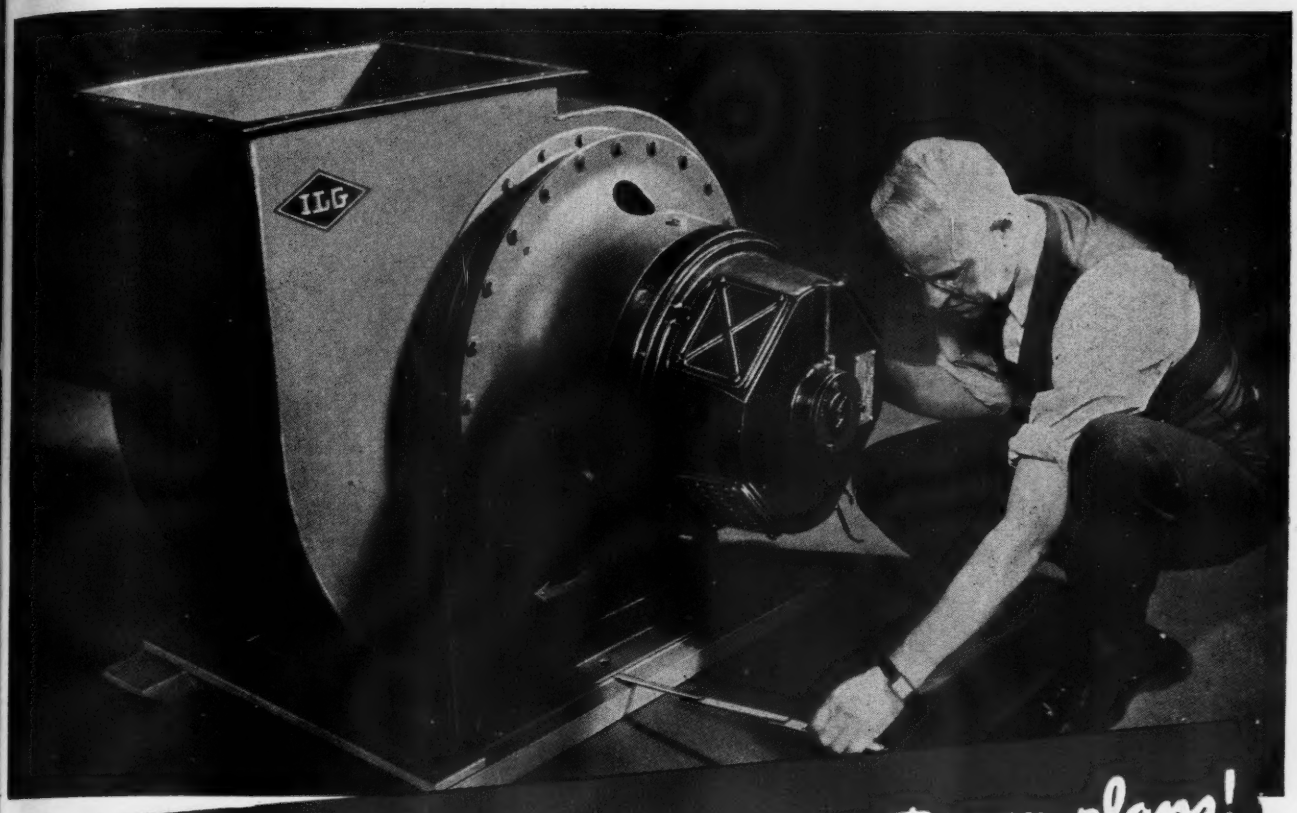
INTERIM AMENDMENT NO. 86

Revision of Interim Amendment No. 70, new Article 670 approved August 4, 1942; amend by substituting the following for the present text of section 6721.

6721. Sizes Permitted—Branch circuit and control conductors in or on a machine shall not be smaller than No. 14 except as follows:

a. *Copper-Clad Steel Conductors*—No. 16 solid copper-clad steel (molten-welded to core), Type SN insulated, having a minimum conductivity of 30 percent of the corresponding size of copper wire may be used for fixed wiring.

Note: For the purpose of this subparagraph, the current-carrying capacity of No. 16 copper-clad steel, SN insulated, conductors shall be seven amperes.



put this blower in your post-war plans!

Designed specifically for installation aboard ship, *where every inch counts,* these new "CC" type all-steel welded ILG Blowers will be available just as soon as Uncle Sam's wartime requirements are handled. Even in this illustration picturing the unit with a marine motor you can see the many advantages of ILG's compact construction... direct-connected motor partially recessed into blower side (no belts, no pulleys, no separate motor mounting)... wheel mounted directly on motor shaft for single operating unit with fewer wearing parts..."factory-set" alignment to lengthen bearing life and prevent vibration... a self-contained blower which is tested and shipped completely assembled, ready to roll or suspend into position. Saves you time and money all along the line—installation, operation and maintenance! For your post-war plans, get details on this new Blower from nearby Branch Office (consult classified directory) or write us.

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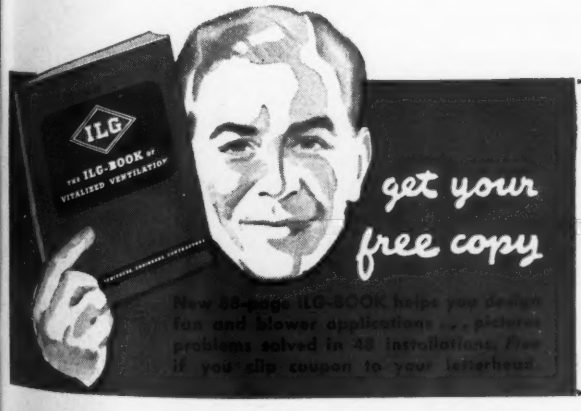
VITALIZED VENTILATION

AND AIR CONDITIONING



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b. *Conductors in Flexible Cable*—Copper conductors in flexible, non-metallic, multi-conductor control cable to continuously moving parts may be No. 16 if all such conductors are insulated for the maximum voltage of any conductor in the cable.

c. *Electronic and Precision Device Conductors*—Copper conductors to electronic and precision control devices may be No. 20, except if pulled into raceways they shall not be smaller than No. 18.

The Electrical Committee is planning to hold a meeting the latter part of 1944 to provide for a 1945 Edition of the National Electrical Code.

Members, cooperating bodies, individuals and organizations in the electrical industry and others having suggestions for amendment to the 1940 edition of the National Electrical Code should file these with the secretary of the Electrical Committee or with the undersigned as chairman, or, if preferred, with the chairman of the Article Committee concerned.

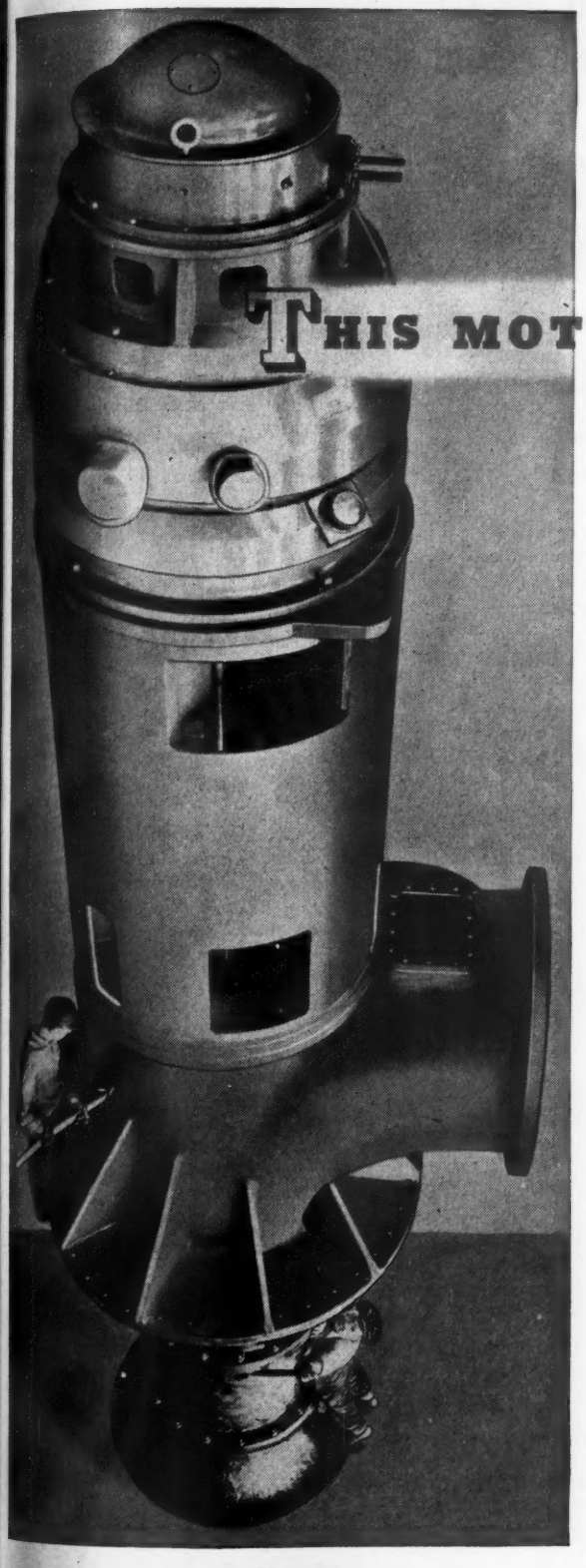
It has been proposed that a new committee of the Electrical Committee be formed to consider the subject of prefabricated house wiring and appropriate National Electrical Code provisions. This committee is to study the matter and report back to the Electrical Committee this fall.

ELECTRIC INSTITUTE HOLDS ANNUAL MEETING

The Electric Institute of Washington, D. C., held its tenth annual membership meeting at the Hotel Statler on March 21. Eric Johnston, president of the Chamber of Commerce of the United States was the principal speaker and his subject was "American Business and the Peace."

Other speakers were Dr. William McClellan, chairman of the board, Union Electric Co. of Missouri and member of the board of directors of Potomac Electric Power Company, Washington, D. C., whose topic was "The Electrical Industry"; Alfred G. Neal, president, Potomac Electric Power Company, on "Electric

***ERIC JOHNSTON,** president of the Chamber of Commerce of the United States, addressed the annual meeting of the Electric Institute of Washington.*



THIS MOTOR PUSHES A "RIVER"

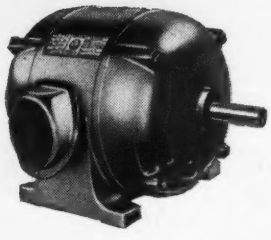
Surface condensers for power generating stations require the pumping of literally "rivers" of water. 40,000 gallons per minute is a lot of water, yet that is the capacity of this vertical, propeller-type circulating pump—a type now being used by a number of large utility companies.

To push that much water around takes plenty of power, and this specially designed Westinghouse motor delivers the 350 hp punch necessary to do the job.

You'll probably never need a motor to "push a river"—but the same kind of engineering skill that goes into such specialized motor jobs is back of every Westinghouse motor you buy.

This ready-to-use experience is available to you for wartime needs—or in planning for postwar conversion. It can help you solve any drive problem quickly—with a motor exactly fitted to the job. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

J-21300



This is only one of the many Westinghouse general-purpose motors available in standard and special enclosures. Features include choice of sealed-sleeve or ball bearings; Tuffernell insulation; dynamically balanced rotor; rigid one-piece frame; die-cast rotor; radio-frequency tested insulation.

Westinghouse motors

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Utility Service"; J. S. Bartlett, Managing director of the Institute discussed "Results of Cooperative Effort."

Preceding the business session, there was a reception and a dinner for Institute members and their guests. George F. Kindley, vice-president of Edgar Morris Sales Company, Washington, presided at the business meeting, at which the newly elected Institute officers for the ensuing year were installed. Elected for the year 1944, were L. S. McCarthy, president (Divisional Merchandise Manager, Woodward and Lothrop); N. H. Barnes, vice president (Sales Manager, Potomac Electric Power Co,); K. D. Boucher, secretary (Sales manager, The United Clay Products Co.); N. E. Burdette, treasurer (Secretary, Refrigeration Supply Co., Inc.) Mr. Kindley was the retiring president.

ORDER L-78 AMENDED

Restrictions on the use of metal in fluorescent lighting fixtures have been further relaxed by the War Production Board. Order L-78, as amended effective April 21, removes former prohibitions on the use of metal to close the ends of reflectors, and in shields, louvers, and baffles.

The use of metal in reflectors was permitted and weight limitations on ferrous metal used in other parts of fluorescent lighting fixtures were removed by an amendment to the order, issued on April 3, 1944. However, restrictions on nonferrous metal in other WPB orders remain in force.

Prohibition of manufacture of certain types of fixtures except upon specific WPB authorization has been extended to include several types formerly permitted. Prohibited types of fixtures are those designed for: (1) one tube of any wattage, unless the fixture is an industrial portable or an industrial attachable model; (2) a continuous row of single tubes of any wattage; (3) two tubes rated 30 watts per tube or less, unless the fixture is an industrial portable or an industrial attachable model; (4) three or more tubes rated 30 watts per tube or less; (5) five or more rows of tubes of

IOWANS Wm. Tofte (left) Waverly contractor and Ed Davidson, Osage contractor enjoy shop talk and cigars during an intermission at the St. Paul N.C.E.I. War Conference.

any wattage in either an individual fixture or in a continuous row section.

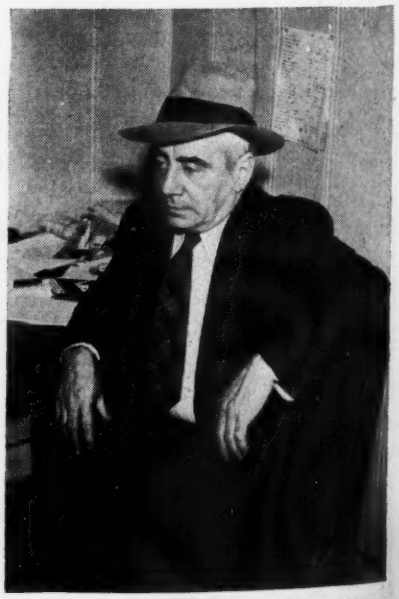
Prohibited types are those considered generally less essential to the war program, Building Materials Division officials said. In general, authorization to manufacture these types will be granted only when it is clearly shown that they are required to fill specific orders and where the use of permitted types of fixtures would mean a waste of manpower or materials; or when it is clearly shown that illumination from permitted types of fixtures would be definitely less effective. Moreover, the Division points out, authorizations to manufacture the restricted types will in general be granted only for installation in establishments carrying on highly essential war work.

New fixtures may be sold only to fill rated orders. However, if the supplier knows or has reason to believe that a rating lower than AA-2 is a blanket MRO rating, orders bearing such ratings must be regarded as unrated. Certain exemptions are provided to take care of special cases.

After getting specific WPB authorization, inventories of completely assembled fixtures manufactured before June 2, 1942 (when inventory reports were originally required) may now be sold to fill unrated orders. Formerly such fixtures could be sold only to fill orders with ratings of B-2 or better.

Fixtures manufactured from material in inventory on April 20, 1942, may be sold only to fill rated orders, whereas formerly such fixtures could be sold without ratings.

Manufacturers who need additional allotments of metals as a result of the relaxation of metal restrictions, may file interim CMP 4B applications in the nearest field office, Building Materials Division officials said. Applications for authorizations required under the order are filed in Washington.



***ADOLPH BRAUNSCHWEIG,** partner of Loyd Electric Co., San Antonio, Texas, motor service organization. Making conveyor drives from rebuilt gear reducer units with V-belt motor drives is one phase of the shop activity.*

A Third CITATION

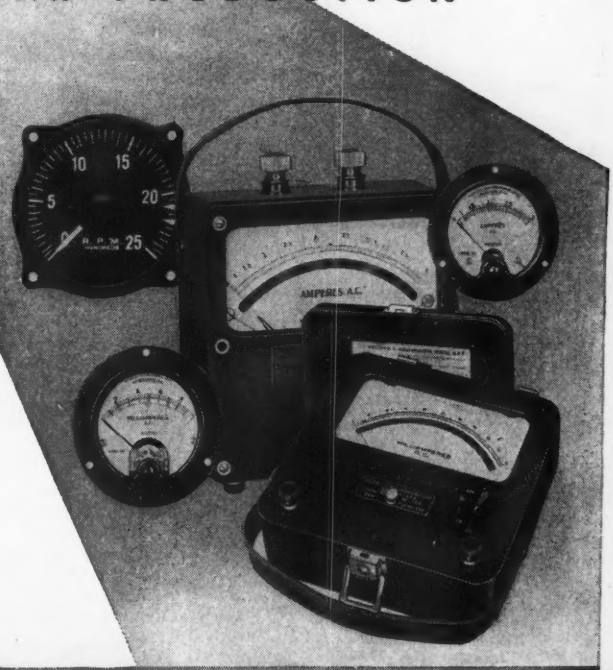
FOR THE INSTRUMENT LEADER

. . . FOR MERITORIOUS WAR PRODUCTION

This third citation for meritorious war production . . climaxing a long record of war service . . . is a source of justifiable pride to the men and women of WESTON.

The record began back in the earliest days of our defense period, when a large segment of WESTONS' capacity was assigned to the production of instruments vital to military needs. Thus, when we finally were forced into this world struggle, WESTON was ready for *full-scale war production.*

This new star which adorns our "E" pennant marks the *third* time WESTON has been *first* in this highly specialized field to receive each successive war citation. Weston Electrical Instrument Corporation, Newark 5, New Jersey.



Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transfomers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

FOR OVER 55 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

PARTS AND MATERIALS AVAILABLE FOR REFRIGERATOR REPAIRS

WPB has warned refrigerator repairmen to prepare now for the summer rush and has outlined how they can best assure themselves of the materials, parts, motors, manpower, gasoline and tires with which to meet increased demands of the coming season.

Under Controlled Materials Plan Regulation 9-A, WPB pointed out, repair shops may obtain parts and materials for domestic refrigeration repairs. Order P-126 provides similar authorization for service to commercial and industrial refrigeration. WPB emphasized that materials and parts are somewhat less difficult to obtain today than they have been, and that the fact that orders for these were unfilled in the past should not preclude submission of another order.

Some new fractional horsepower motors are beginning to appear on the market despite the fact that these are among the tightest of all components. WPB urged repairmen to operate on an exchange basis with motor repair shops wherever possible, turning in an unworkable motor for a similar-size rebuilt motor.

As regards manpower, WPB reminded refrigerator repairmen that they hold essential jobs in an essential industry and that as such, they are eligible for occupational deferment. It emphasized, however, that deferments are not permanent but are granted under Selective Service rules to allow the opportunity to locate and train capable replacements. It urged that discharged veterans, over-age men and women be recruited through the United States Employment Service—and trained by War Manpower Commission's training program—to provide sufficient repairmen to keep refrigeration in operation.

Arrangements for the extra gasoline and tires which may be required during

AG ENGINEER Norton Ives, University of Minnesota, tells N.C.E.I. Rural Electric Clinic of the need for specifically designed electrical equipment for farm applications.

the summer peak should be made now through the Office of Defense Transportation and the Office of Price Administration, WPB warned, outlining the procedures by which extra rations or tires may be had.

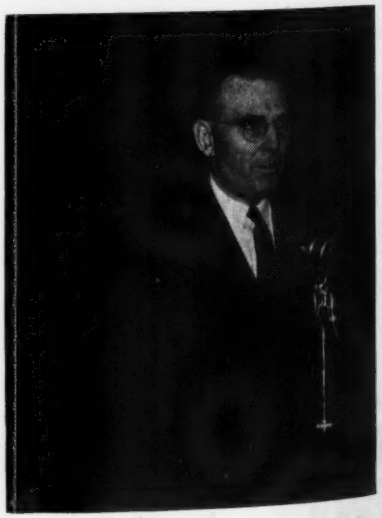
DIRECTION NO. 18 TO CMP REGULATION NO. 5

Information which should be given by persons applying for increases in their maintenance, repair and operating supply (MRO) quotas under CMP Regulation No. 5, has been covered in Direction No. 18 to that Regulation by Materials Plan Division of the War Production Board.

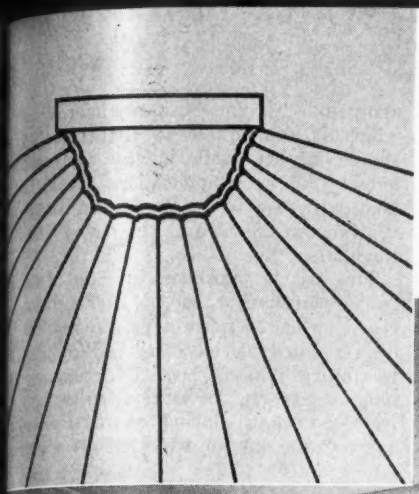
Items of information which should be given are:

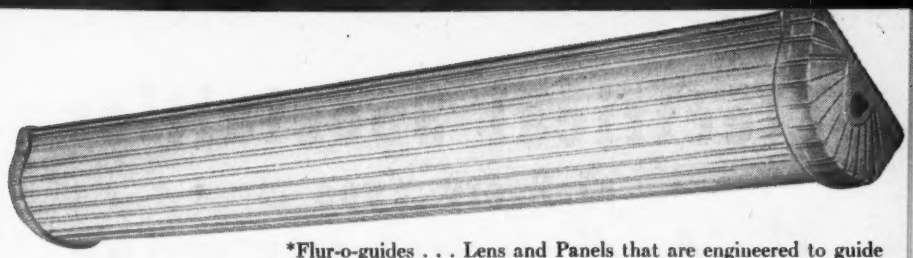
1. Name of product(s) manufactured or description of services rendered;
2. Show what quarterly quota you were authorized under paragraph (f) in 1943. (If operating on a seasonal basis, show for each quarter of 1943). If you received a special authorization for any quarter, show that for each such quarter in addition to the "base" quota;
3. Statement of total dollar value of deliveries of your product in 1942, and first and subsequent quarters of 1943, by quarters. Show deliveries for each quarter by principal Claimant Agencies;
4. Statement of total amount of MRO requested to be authorized per quarter. This should include the base quota already permitted by paragraph (f) (1), (2), or (3) plus the increase requested;
5. Statement of total amount expended during 1943 for minor capital additions under paragraph (b) (3) of the regulation;
6. Statement of deliveries of your product scheduled for quarters for which MRO increase is requested; and
7. Any additional information which may be pertinent to proper evaluation of the application.

If any of the above questions do not

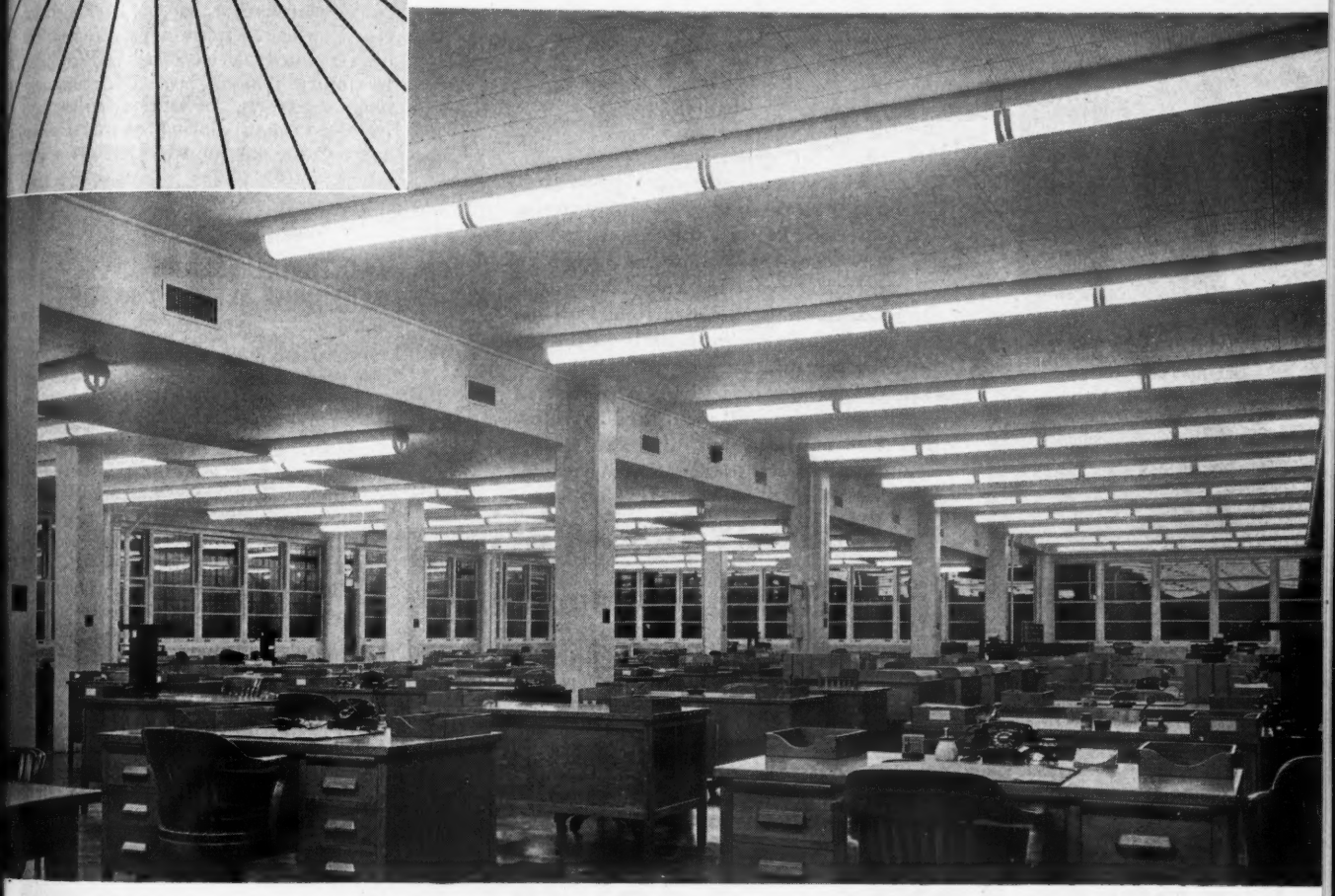


GOVERNOR THYE of Minnesota commends the cooperative spirit of Minnesota's electrical industry at luncheon of N.C.E.I. at recent War Conference in St. Paul.





*Flur-o-guides . . . Lens and Panels that are engineered to guide fluorescent light to the areas where it's needed, without eye fatigue.



CORNING *Flur-o-guides**

ENGINEERED LIGHT THAT MAKES WORKERS' JOBS EASIER—

IS EASIER TO SELL

Corning *Flur-o-guides*, through the application of correct engineering principles, enable you to supply your customers with *efficient* fluorescent lighting. Engineered lighting is versatile. The light rays can be diffused over a wide area, through the use of the proper lenses or panels. In every instance, they provide glareless, eye-easy, efficient light. And Corning *Flur-o-guides* blend pleasingly into any architectural plan.

Your customers will welcome this improved type of engineered lighting. You will find it profitable and easy to sell.

WHAT DOES ENGINEERED LIGHTING DO?

Just how engineered lighting works in actual use is shown in the illustrations and diagram above. These Corning "Alba" Diffusing *Flur-o-guides* are made from "Alba," a homogenous glass of medium diffusion and high transmission. Note how these *Flur-o-guides* diffuse the light rays so that they are distributed over a wide area. Note, too, the absence of harsh, direct light in the line of vision, which is one of the causes of eye fatigue.

Write for your copy of "Corning Lighting Data" illustrating the complete selection of scientifically designed Corning *Flur-o-guide* lens and panels, and profitable engineered lighting applications. Address Lighting Division, Dept. EC2, Corning Glass Works, Corning, N. Y.

Corning Glass Works does not manufacture or sell lighting fixtures. Complete standard fixtures are obtainable from fixture manufacturers.

apply to a specific business, information which is comparable to that requested should be set forth in the applicant's letter. All such applications should be filed with the War Production Board, Washington 25, D. C., Reference: CMP Regulation No. 5.

This list is important in view of the recent amendment to CMP Regulation No. 5, which permits a person who has been granted an increased MRO quota, for other than a special circumstance such as retooling, to continue to use such increased quota during quarters subsequent to the one for which it was originally granted.

ADDITIONAL USES OF ALUMINUM ALLOWED BY WPB

Additioual uses of aluminum for products essential to the war effort have been allowed by the War Production Board. Such uses extend to all products and equipment for the military services when the Government specifications call for aluminum. This action has been taken by amending Supplementary Order M-1-i.

In addition to the military uses, but subject to some restrictions, aluminum may be used in commercial communication equipment, fire-fighting equipment, protective signal and alarm equipment, industrial fans and blowers, industrial machines, industrial safety equipment, industrial spray guns and grease guns, engineering instruments, safety control and heating control instruments, internal combustion engines, jigs and fixtures for industrial production, and industrial type lighting equipment.

Although the supply of aluminum has increased, its use is being permitted only for products which contribute materially to the war program. The military services have been returning to aluminum where substitute material had been used. Relaxation of civilian production will not be permitted at present.

J. C. HARDIE, assistant manager, W. M. Smith Electric Co., Dallas, Texas, reports this motor service shop has turned out over 7000 hp. in major motor rewinds and rebuilt equipment sales last year—an impressive record.

HOW MUCH LESS PAPER CAN YOU USE IN YOUR PLANT?

That's a mighty important question. Paper stocks are seriously low this year, and every time another shipload of paper-wrapped war supplies leaves an American port, the problem gets tougher • The voluntary cuts, the simple economies you have put into operation up to now, won't be half enough in 1944 • The only answer is honest, convincing *paper-pinching* by every one who uses paper • Organize a Paper Conservation Committee in your company. Pick only the best men for this job, and give them a green light so that they can work effectively • From envelopes to heavy cartons, have this Committee see to it that functional packaging is the order of the day—every day • In the panel are suggested many ways your plant can use less paper. But you know your own business best! Go to it *NOW!*

Use Less Paper Because

Multiwall paper bags are used extensively in shipping flour and dehydrated foods.

All openings and exposed surfaces of tanks are sealed with paper for shipping.

Submachine guns are not only paper-wrapped but boxed in paper board. Shell grommets, bomb rings and practice bomb fins are made of paper to save needed steel.

Gas-mask canisters and hand-grenade containers are made of paper.

Paper is used in camouflage strips and netting and parachutes.

All Army clothing and equipment are shipped in waterproof paper wrappers.

Use Less Paper These Ways

Condense letters and memoranda by (a) keeping margins as narrow as possible; (b) sticking to single-space forms; (c) using reverse side of incoming letters as first carbon copy of replies; (d) using reverse side of second sheets for carbon copies; (e) using both sides of all mimeographed sheets.

Check carefully to determine whether your shipping container exceeds the requirements of Rule 41 of "consolidated freight classification requirements."

Eliminate individual cartons in every practical instance.

When individual cartons are indispensable, pack in bulk whenever possible.

Control disbursement of paper supplies to employees so that excessive quantities do not accumulate in desks and departmental supply closets.

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

LET'S ALL USE LESS PAPER

Space for this advertisement contributed by ELECTRICAL CONTRACTING

H. F. TRESTER (right), Trester Service Electric Co., Milwaukee motor service shop, takes time out to chat with R. L. Brown, Westinghouse Electric Supply Company, at the recent Milwaukee E.M.E. electrical trade show.

ORDER L-250 AMENDED

WPB has amended order L-250 to lift restrictions on the use of steel for general purpose and semi-dust-tight enclosures for floor-mounted electrical control equipment. The amendment also removes specifications for busbars, connecting straps and control terminals and removed restrictions on the use of aluminum for data plates.

The amendment was designed to provide increased protection of control equipment and eliminate the ordering of explosion-proof and dust-tight enclosures where they are not absolutely necessary.

LIMITATION ORDERS L-89 AND L-41

An interpretation to Limitation Order L-89 issued by the War Production Board explains that the order's provision permitting acquisition of $500 worth of elevator parts on an AA-5 or better priority rating refers to materials for maintenance and repair. Labor cost for installation need not be included in this maximum dollar allowance, according to WPB.

The interpretation also points out that in the event any repairs costing more than $500 for materials and labor are designated as minor capital additions, the elevator owner must obtain approval of his order. If, on the other hand, repairs are carried on the books of the owner as a maintenance charge, the maintenance repair order provisions will suffice as approval for his order.

Applications for authorizations to install a new elevator to replace an existing one, or for installation in an existing

shaft, providing such replacement or installation involves construction as defined in Limitation Order L-41, should be filed on Form WPB-1236 with Form WPB-617.

Another feature of the amended order increases the dollar value of inventory spare parts not for immediate use that may be acquired by the owner of an elevator from $25 to $50, and from a total of $50 to $100 for any calendar year. Acquisition of both small inventories and capital additions up to $500 may be obtained under the provisions of CMP Regulation 5.

ELECTRICAL CONNECTORS EXCLUDED FROM WPB PROCEDURES

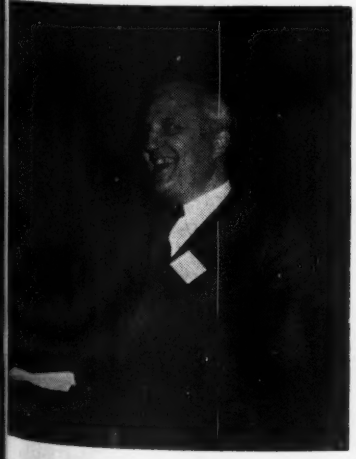
Electrical connectors, specifically "AN" type, similar to "AN" type, and coaxial cables, have been excluded from War Production Board scheduling procedures. These items, which were formerly undesignated products under the terms of General Scheduling Order M-293, have been removed from control of the order because of favorable supply conditions, it was pointed out.

Manufacturers of these products will no longer be required to file their monthly shipping schedules with the Building Materials Division, even though they have been requested to do so in the past.

INTERPRETATION NO. 23 TO CMP REGULATION NO. L

The definition of the word "steel" as used in Controlled Materials Plan Regulations has been clarified by an interpretation, the War Production Board has announced.

"Steel" as used in CMP Regulation No. 1 means all carbon steel (including wrought iron) and alloy steel in the



POSTWAR REPORT *of the N.C.E.I. Central Planning Committee is presented to delegates at recent War Conference by chairman L. G. Mample of Minneapolis. Report contains specific recommendations of various trade groups.*

forms and shapes that are designated as controlled materials (these designations are contained in Schedule I of CMP Regulation No. 1). The term includes all types of rejected or second quality material and shearings, except when sold as scrap for remelting or when sold to a dealer for sorting or processing or for resale as scrap for remelting. The term includes material (in the forms and shapes indicated in Schedule I) salvaged from scrap and sold for other than remelting purposes, except that it does not include material that has been in use or service.

This clarification, which is contained in Interpretation No. 23 to CMP Regulation No. 1, conforms the definition of "steel" in CMP Regulation No. 1 to the definition used in the M-21 series of WPB orders.

OPA AUTHORIZES PRICE INCREASE TO EIGHT PRODUCERS OF BX CABLE

A price increase of 10 percent has been authorized by the Office of Price Administration for eight producers of armored (BX) cable to bring their prices to the level of the other five producers.

The new ceiling is $30.60 per 1,000 feet of No. 14-2BX cable, which type represents more than half all sales, delivered in Zone 1-A.

The eight producers affected by the order had delayed establishing a general price increase in October, 1941, and were prohibited from charging the new price when prices were frozen at levels of Oct. 15, 1941. The other five manufacturers had boosted their prices before the freeze became effective. The new order puts all 13 producers on the same basis.

Production of armored cable was halted in September, 1942, and reauthorized a year later.

AMENDMENT TO ORDER L-315

All restrictions on the gauge of steel allowable for enclosing cases, fronts and doors of safety switches, panelboards and service entrance equipment have been lifted by WPB in a move to improve quality and performance of these items. The action was contained in an amendment to Order L-315, which also removed a ban on the use of doors in panelboards.

PROCEDURE FOR HOUSING CONSTRUCTION APPLICATIONS SIMPLIFIED

By consolidating within a single agency full responsibility for practically all non-farm housing projects, the War Production Board has further simplified the procedure for the processing of housing construction applications.

The first step in the delegation of authority for construction applications

was taken on March 1, 1944, when the War Production Board delegated to the National Housing Agency the right to approve all programmed war housing applications. Effective April 1, 1944, WPB will delegate to NHA full authority to completely process most other housing applications.

As set forth in policies and criteria established by WPB in consultation with NHA, the following broad types of housing construction, alteration and improvements will be under the jurisdiction of NHA:

1. Housing programmed specifically for essential war workers.

2. Housing to relieve situations of extreme general hardship in communities resulting from a lack of housing accommodations (only to the extent programmed by NHA and to the extent that WPB makes materials available or otherwise approves. No materials for this type of construction are being made available at this time).

3. Housing to relieve present or impending personal hardship to a specific individual or his family, arising from an increase in dependents or consolidation of the family or from considerations of health, physical disability, or safety.

4. Reconstruction or replacement of housing damaged or destroyed, or removed from the market by condemnation or acquisition by public authorities.

Exceptions are: applications for (1) farm housing and mobile farm labor camps, (2) housing built by or under direct management of the military services, (3) hotels and similar establishments of more than ten rooms providing housing primarily for transients, (4) institutional housing—dormitories and other housing owned and operated as an integral part of an "institution" as defined in CMP Regulation No. 5A, (5) mobile housing units (trailers), (6) residential construction built by an "operator" as defined in Order P-98-b under a Petroleum Administrative Order of PAW, (7) housing consisting of not more than ten dwelling units built as an integral part of a project undertaken primarily for the construction of an isolated utilities plant addition, such as a

THE HAZARDS of farmers doing own wiring receive attention of (L. to R.) George Garney, executive-secretary, State Board of Electricity, St. Paul, Minn., and A. J. Jensen, Interstate Power Co., Crookston, Minn.

gas compressor station or hydroelectric plant, and (8) the alteration, betterment, repair or replacement of structures, facilities equipment or fixtures intended primarily for a commercial establishment located in a dwelling structure. Applications for construction of these types will continue to be filed as heretofore.

PRESENT CONSUMPTION OF METAL FOR LAMPS TO CONTINUE

Consumption of tungsten and molybdenum for incandescent and fluorescent lamps will continue in the immediate future at the present rate, WPB officials told its Incandescent and Fluorescent Lamp Industry Advisory Committee last month. Little change in the production of these metals is now anticipated.

Committee members said the plan whereby manufacturers set aside stipulated percentages of switchboard lamp production to fill orders from specific classes of users had operated efficiently to enable them to catch up on back orders.

CONTRACTORS TO FURNISH EQUIPMENT HOUSING PROJECTS

Contractors on publicly-financed war housing projects will furnish in the future items of equipment heretofore handled through mass purchase by the Federal Public Housing Authority, as announced by Commissioner Herbert Emmerich.

Such items as plumbing and heating equipment, and lighting fixtures, will be included in construction contracts again as they are under normal building conditions. Inclusion of ranges and ice boxes is at the option of FPHA Regional Directors.

"Mass purchasing was resorted to as a temporary war measure early in 1942, when shortages of critical materials and necessary limitations on manufacture threatened to impede production of essential war housing," Mr. Emmerich said. "This centralized buying, arranged in cooperation with the War Production

SAN ANTONIO CONTRACTORS Nathan Alterman (left) and E. G. Zoller air industry conditions at recent monthly luncheon meeting of the South Texas Chapter, NECA in San Antonio.

Board, initiated the first Victory models of housing equipment, stripped down in design to conserve critical materials. By placing mass orders, we enabled manufacturers to open production lines which yielded sufficient quantities to serve war housing as well as other military and civilian war needs."

The FPHA has a stockpile of equipment which will be sufficient for the next three months' housing demands. In the meantime, FPHA has begun liquidation of the central buying activities through which more than $80,000,000 of equipment has been purchased for approximately a billion dollars of war housing. Fully three-quarters of this total amount was furnished FPHA by small manufacturing concerns throughout the country.

NECA COORDINATES TEXAS CONTRACTORS

For the first time in many years electrical contractors in the state of Texas are engaged in active organizational work. A new enthusiastic spirit of cooperation has sprung up since the organization and reorganization of four NECA chapters which engulf 188 counties in the state and to date have a total roster of approximately 70 members. Headquarters of these chapters are located at Dallas, Fort Worth, San Antonio and Houston.

Until the end of last year Texas contractors were head over heels in war plant construction and hence had little if any time to consider postwar problems —the immediate consideration being to get the plants in operation. Now that this work is at an end, much thought is being given to the immediate and postwar future including house wiring, REA work, better wiring standards, surplus

ENTHUSIASTIC and hard working "Jim" McClure, president, Dallas Chapter, NECA feels that a healthy organization with a progressive program is the Texas electrical contractors only postwar salvation. Jim has been active in organization work for more than 18 years.

materials, and the postwar industrial expansion which Texans foresee as a result of the industries that have located there and the natural resources the state possesses.

The Fort Worth Chapter, oldest of the group, covers 63 counties. Secretary-manager M. T. Dorsett has 18 members under the chapter jurisdiction. Dallas, with 18 members, covers 44 counties and has as its business manager W. C. Bryant, formerly of Kansas City, Mo. James L. McClure, McClure, Electric Co., president of this group lends an enthusiasm that is contagious.

The southern half of the state is covered by two chapters, the South Texas Chapter with headquarters in San Antonio and Southeast Texas Chapter (formerly the Houston Chapter) with headquarters in Houston.

On March 1, 1944 the name of the Houston Chapter was changed to The Southeast Texas Chapter, NECA since its jurisdiction covers 27 counties in the southeastern part of the state. Charles Scholibo is the new business manager of this group. The 17 members elected the following officers to guide the chapter activities during the coming year: president, Chas. E. Seiders, Seiders-Schnorbus Co.; vice president, W. G. Poole, Gulf Electric Co.; and treasurer, W. H. Kirk, W. H. Kirk Electric Co.—all of Houston.

Although, as an entity, there is no state contractors organization, the present setup operates much the same. Chapter managers meet regularly to discuss their problems and coordinate their activities on a state basis. District meetings of all chapter members are held semi-annually, the latest one being held recently at Fort Worth.

N. C. E. I. ORGANIZES RURAL ELECTRIC COUNCIL

Sensing the need for some type of organization to foster the present and postwar application of electrical equipment in farm production of food, textiles, chemicals and other materials produced on farms in the North Central area, the North Central Electrical Industries of Minneapolis, Minn., recently launched a new division—the Rural Electric Equipment Council. Present at the organizational meeting were representatives of farm and electrical equipment manufacturers and distributors, R.E.A. cooperatives, commercial electric utilities, farm publications, the State Board of Electricity, electrical contractors and dealers, building materials distributors and the farmer himself.

The greater portion of the meeting was devoted to an open forum discussion of the many practical problems that could be solved to help farmers obtain better electrical equipment, more efficient usage of same and the elimination of hazards and maintenance troubles. The need for a widespread educational program and active promotion of adequate, safe, farm wiring installations was evidenced when numerous cases of unsatisfactory service and electrical hazards to livestock and

arm personnel due to improper wiring were cited by those present.

The aims of this newest division of the N.C.E.I. are to gather and disseminate information relevant to farm electrification and to promote the effective use of properly designed rural electric wiring, lighting and equipment. The Council will also strive to bring about improvements in the design and performance of present equipment

Officers elected to guide the group in its operations as a clearing house for rural electric problems are: chairman, Chas. P. Wagner, manager, rural service department, Northern States Power Co.; vice chairman, J. L. Fitch, manager, Westinghouse Electric Supply Co., Minneapolis; secretary, Wm. A. Ritt, secretary-manager, N.C.E.I. Chosen to serve on an Advisory Committee to the present officers were: George Bleeker, supt., Goodhue County R.E.A.; W. H. Kircher, editor, "The Farmer"; Sig Anderson, electrical contractor, Maple Plain; E. G. Clinton, equipment dealer, Minneapolis; and Thurber Day, General Elec. Co., Minneapolis.

One of the first actions of the newly organized group was to engage as joint sponsors, with the Minnesota Electrical Inspectors Association, of the Rural Electric Wiring and Equipment session at the N.C.E.I. Electrical Industry War Conference at St. Paul, March 28th.

C. C. E. C. A. EXTENDS ELECTRONICS COURSE

After completing a 15 weeks elementary course in the theory of electronics, members of the Cook County Electrical Contractors Association, Chicago, have pitched into an advanced course on electronic applications. Like the first course, sessions are held bi-weekly and will run for 15 consecutive weeks at the Illinois Institute of Technology. All costs, except textbook material, is underwritten by the U. S. Office of Education Engineering Science and Management War Training Program.

The curriculum is divided into two parts—lecture and laboratory. Tuesday night sessions which started February 22 and run from 6:30 to 8:00 p.m. are devoted exclusively to classroom work; Thursday night sessions run from 6:30 to 10:00 p.m. with 1½ hours of lecture and 2 hours of laboratory work. Subjects covered include: reactance and resonance; ignitron circuits; photo electric controllers and registers; resistance welder and miscellaneous controls; relays; speed, temperature and process regulators; cathode ray tubes; and ultra high frequency heating. Laboratory work follows through with actual experiments performed with the equipment studied in the classroom.

"Industrial Electronics" by Gulliksen and Vedder is the textbook used in this course. Samuel Warner, chief electrical engineer of the Otarion Company, hearing aid manufacturers in Chicago, is the instructor handling both the lecture and laboratory assignments.

Some 20 members of the Association

comprise the "student body" for this advanced course. Each will devote 75 hours of his "free" time during the 15 week interval to gain a working knowledge of electronics in industry. Each is determined to take back to his business this background and knowledge to better serve his customers in the immediate and postwar future.

FRED RIEHLE ELECTED PRESIDENT CINCINNATI CONTRACTORS

At a regular meeting of the Electrical Contractors' Division of the Cincinnati Electrical Association, held on March 20, J. Fred Riehle was elected president for the fiscal year 1944. Other officers elected were: Paul W. Schath, vice president; Wm. J. Wilfert, secretary and

J. FRED RIEHLE

Karl Spangenberg, treasurer. Trustees elected were: Anthony Bang, Fred Horstmann, A. X. Schwebel, Thomas J. Donnelly and Errett W. Edmonds.

Mr. Riehle is owner of the College Hill Electric and Radio Company and has been secretary of the Electrical Contractors Division for the past 18 years, and one of the original organizers of the Division in Cincinnati. He is planning for an enlarged membership to further promote Adequate Wiring in residential building during the postwar period.

JOHN J. CADDIGAN PROMOTED

John J. Caddigan, secretary-treasurer of the Metropolitan Electrical League, has been promoted to the post of assistant vice president of the Boston Edison Company. He entered the employ of Boston Edison in 1904 as a member of its Installations Department. In 1939 he was appointed sales promotion manager, in which position he will continue to function in addition to his new assignment.

Mr. Caddigan's activities in the electrical field have been many and varied. He is one of only seven who have been elected to honorary life membership in the National Electrical Contractors Association. He has been president of the National Electrical League Council, first vice president of the Society for Electrical Development and one of the organizers of the Metropolitan Electrical League.

TEACHES WIRING COURSE

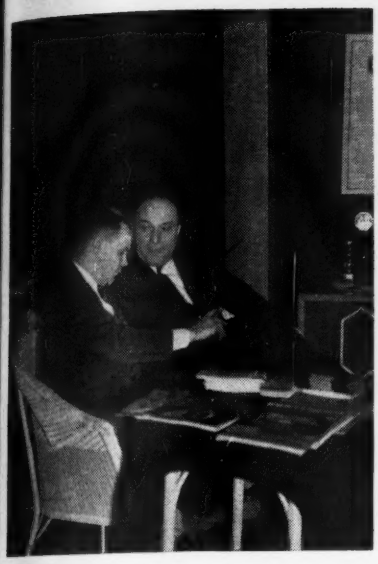
That wiring layout is receiving serious consideration in illumination courses is a promising note. Listed among the 15 subjects covered in the advanced illumination engineering applications course, sponsored by the Chicago Lighting Institute and the Illinois Institute of Technology in Chicago, is a class on wiring layout.

The instructor is Ralph H. Decker, consulting electrical engineer who previously has conducted courses on estimating and power and lighting design for the Cook County Electrical Contractors Association, Chicago. Mr. Decker lends to his class his vast experience in the electrical construction field—having been a contractor himself, then engineer for various electrical construction firms before going into his consulting practice.

OKLAHOMA CONTRACTORS ORGANIZE

Electrical contractors in the state of Oklahoma have recently formed an organ-

***ENTERPRISING** and progressive Paul Wright is one of the top ranking members of the San Antonio, Texas, electrical contracting fraternity. Paul has done a good share of the big work and is vice-president of NECA's South Texas Chapter.*



SERVICE PROBLEMS are aired by C. L. Harry (left), shop supt., Holt Electric Motor Co., Milwaukee motor service shop and "Ad" Gogan, Milwaukee electrical contractor in the Holt booth at the recent Milwaukee E.M.E. electrical trade show.

ization designated as the Oklahoma State Chapter, NECA, with headquarters in Oklahoma City.

Officers elected at the initial meeting held at Tulsa on Feb. 25th are: president, C. D. Snyder, vice-president, Wetherbee Electric Co., Oklahoma City; vice-president, L. T. Allen, Allen Electric Co., Tulsa; treasurer, H. J. Reeves, secretary, McEldowney & Son, Oklahoma City.

The selection of a secretary-manager for the new NECA Chapter was deferred until a future date.

J. L. PHILLIPS JOINS CLAYTON COMPANY

J. L. Phillips has recently joined the engineering staff of J. M. Clayton Company, contracting electrical engineers of Atlanta, Ga. Mr. Phillips is a graduate of the Georgia School of Technology, was formerly associated with the Georgia Power Company of Atlanta; Allied Engineers, Inc., Alabama Power Company and the Rust Engineering Company of Birmingham, Ala.

He has recently served as project manager for Juneman Electric Company, in charge of the construction of the complete electrical system for the Huntsville Arsenal and Redstone Ordnance Plant, Huntsville, Ala.

ALL STAR CAST

It isn't often that nationally known figures, particularly in the sports world, are to be found in electrical contractors' organizations. Arthur Allen, vice-president, Maritime Electric, Inc., Houston, Texas, hit the jack pot with two big league baseball players this winter.

Arthur, who is doing considerable work for the Maritime Commission and the Navy at Galveston shipyards had Harry Gumbert, who toes the slab for the St. Louis Cardinals, in the ship wiring and repair crew. Harry, who has been a journeyman electrician since 1935 found some years back that he could do things with the horsehide and has been baffling opposing batters since. Winter found him in there pitching on the production front.

Gus Mancuso, who spends his summers squatting behind the plate for the New York Giants, was on the receiving end at Maritime Electric also. His job as purchasing agent and material expediter kept him more than busy supplying the boys on the ships with the equipment needed.

After doing their bit on the production front both athletes are now in spring training preparing to do their part in maintaining civilian morale

INTERPRETATION No. 4 TO CONSERVATION ORDER L-41

The erection of a portable or pre-fabricated building, when placed on a foundation constructed on the site or on skids in a spot where it is intended to remain for an undetermined time is construction and as such is limited by the restrictions of Conservation Order L-41, the Facilities Bureau of the War Production Board has ruled.

The only case in which the erection of a portable or pre-fabricated building is not "construction" is when it is placed on what is intended to be a temporary site with the purpose of moving it from time to time and without affixing it to the land by plumbing, public utilities connection, or in any other way.

For example, the erection of a portable structure for use as a gargae on a house lot is generally construction, but the erection of a shelter to be moved around for use on different parts of a farm from time to time is not construction.

This clarification is covered in Interpretation 4 to Conservation Order L-41.

Book Reviews—

MAINTENANCE ARC WELDING

Maintenance work, in which the welding arc had its original application, has always been and will remain a most important field of usefulness. Arc welding has accounted for tremendous savings in the industrial field in both production and maintenance work. It has been indispensable in maintaining our great war production machine, not only in the reclamation

of broken and worn parts of machinery and structures but also in the fabrication of replacements at great savings.

The new book is a collection of papers, each from a different field of industry. The individual papers include information on procedure, and how arc welding has been applied to its own maintenance projects. Calculations and computations are also given on costs which include fabricating material, welding rod, machining, grinding, etc. Labor costs and overhead charges are also shown.

As an indication of the scope of the material, one paper deals with bakeries, another with blast furnaces and still others with farm machinery, refineries, generating stations including turbine maintenance, mining operations and many other industrial and manufacturing establishments.

The book is "Maintenance Arc Welding" published by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, 50 cents.

MAINTENANCE AND SERVICING OF ELECTRICAL INSTRUMENTS

Electrical indicating instruments have for many years been essential to the operation and maintenance of industry's machinery. They have now become essential to the operation of war combat machines on an extremely large scale. Instrument manufacturers have been so completely tied-up with production of new meters that servicing old ones has been impossible. Thus this book has been written for the instrument users, switchboard attendants, testing engineers and instrument service men, both in industry and in the service, to enable them to intelligently handle and maintain their instruments for long and efficient life.

Each general type of instrument in common use is first covered with a simple explanation of the underlying principle of

FROM SOUTH DAKOTA, engineers Everett Baxter, (left), Central Electric and Telephone Co., Sioux Falls; and L. P. Ulrich of same company at Woonsocket, relax between sessions at recent N.C.E.I. War Conference at St. Paul, Minn.

operation, and is followed by specific and detailed instructions on maintenance and repair.

The book is titled "Maintenance and Servicing of Electrical Instruments" by James Spencer and published by the Instruments Publishing Company, Pittsburgh, Pa. It is bound in Fabricoid with 256 pages and 274 illustrations. It is pocket size—5 inches by 8¼ inches and the price—$2.00.

INDUSTRIAL ELECTRONIC CONTROL

The increasing use of electronic devices in industry has placed a heavy burden upon the men who sell, install and maintain them. This new book has been written especially for these men who have had no previous tube experience.

No attempt is made to explain the theory and construction of electron tubes or their use in high-frequency communication circuits. Nor does it deal with specific industrial applications of electronics.

Rather, it has been written to emphasize basic circuits that may be combined to form an endless variety of complete circuits to meet practically any desired operating requirements. The functions of the various tubes as integral parts of circuits are stressed, rather than the phenomena taking place within the tubes themselves.

Explanations are brief; and mathematical formulas, of interest only to designers, are avoided. Common circuit components and elementary circuits are described separately and then combined to assist the reader in analyzing a complicated circuit.

The book is "Industrial Electronic Control" by W. D. Cockrell, priced at $2.50 and published by McGraw-Hill Book Co., Inc., New York City.

MARINE WIRING SPECIALIST, Arthur Allen, vice-president, Maritime Electric, Inc., Houston, Texas, has some 203 voyage electrical repair jobs to his credit at Galveston shipyards. His company is also doing ship conversion and new wiring work.

DATES AHEAD

National Fire Protection Association—Annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 8-11.

Pacific Coast Electrical Association—Annual meeting, northern section, fairmont Hotel, San Francisco, Calif., May 10; southern section, Ambassador Hotel, Los Angeles, Calif., May 17.

Southeastern Electric Exchange—Annual conference, Atlanta Biltmore Hotel, Atlanta, Ga., May 10-11.

Pennsylvania Electric Association—Electrical equipment committee, Lancaster, Pa., May 10-11. Systems operation committee, Benjamin Franklin Hotel, Philadelphia, Pa., May 11-12.

Dakota All-Electrical Industry War Conclave, Fargo, N. D., May 14-15.

Arkansas Utilities Association—Annual convention, Marion Hotel, Little Rock, Ark., May 15-16.

National Metal Trades Association—Hotel Biltmore, New York, N. Y., May 15-18.

Tennessee Electrical Contractors Association—Annual Meeting, Claridge Hotel, Memphis, Tennessee, May 16-17.

American Standards Association—Standards Council, New York, N. Y., May 18.

Electrical League of South Jersey, Spring Conference, Woodbury Country Club, Woodbury, N. J., May 19.

Illuminating Engineering Society—Great Lakes Regional meeting, Cincinnati, Ohio, May 20.

Electric League of Indianapolis, Inc.—All-Industry meeting, Lincoln Hotel, Indianapolis, Ind., May 26.

Illuminating Engineering Society—Rocky Mountain Chapter, Denver, Colo., May 31.

Public Utilities Advertising Association—Annual meeting, Palmer House, Chicago, Ill., June 6-8.

Roger Williams Chapter IAEI—Monthly meeting, Providence, R. I., May 17.

Rocky Mountain Chapter IAEI—Monthly meeting, Room 385, City and County Building, Denver, Colo., June 13.

National District Heating Association—Annual meeting, William Penn Hotel, Pittsburgh, Pa., June 14-15.

Iowa Utilities Association—Postwar planning conference, Des Moines, Iowa, June 19-20.

American Society of Agricultural Engineers—Annual meeting, Schroeder Hotel, Milwaukee, Wis., June 19-21.

American Society of Mechanical Engineers—Semi-annual meeting, William Penn Hotel, Pittsburgh, Pa., June 19-22.

Society for Promotion of Engineering Education—Annual meeting, University of Cincinnati, Cincinnati, Ohio, June 25-28.

American Institute of Electrical Engineers—Summer Technical Meeting, Jefferson Hotel, St. Louis, Mo., June 26-30.

American Society for Testing Materials—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30.

International Association of Electrical Inspectors — Northwestern Section, Olympia, Wash., August 21-23; Southwestern Section, San Francisco, Calif., August 28-30; Western Section, Indianapolis, Ind., September 11-13; Eastern Section, New York, N. Y., September 18-20; Southern Section, Atlanta, Ga., September 25-27.

American Institute of Electrical Engineers—Pacific Coast Technical Meeting, Biltmore Hotel, Los Angeles, Calif., August 29-September 1.

American Standards Association—Standards Council, New York, N. Y., September 21.

National Electrical Contractors Association—Annual meeting, French Lick Springs Hotel, French Lick, Indiana, Oct. 1-5.

National Safety Congress of National Safety Council—Sherman, Morrison and La Salle Hotels, Chicago, Ill., October 3-5.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 23-27.

MANUFACTURERS NEWS

GRAYBAR APPOINTMENTS

Charles S. Powell has been elected a vice president and director of the Graybar Electric Company, N. Y. He began his career with Graybar 30 years ago immediately after attending Stanford University and Case School of Applied Science where he was graduated in Electrical Engineering. Mr. Powell will continue to head up all company sales activities in communications and merchandising lines.

C. S. POWELL

George T. Bryant has been appointed Hearing Aid sales manager and is located at Graybar headquarters at 420 Lexington Avenue, New York. For the past two years, Mr. Bryant has been in Washington, D. C., first as chief of Trade Relations Branch, Retail & Trade Service Division, OPA and later, when Lend-Lease was merged with the Foreign Economic Administration and the operations combined, he was reappointed chief of the General Products Division.

G-E CHANGES

Harold E. Strang, for the past three years engineer of General Electric's Philadelphia Works, has been named to the staff of H. A. Winne, vice president in charge of design engineering, Apparatus Department. Mr. Strang will be located in Schenectady.

Two new wholesale distributing branches have been established in Cincinnati and St. Louis by G. E. The branch in Cincinnati will cover both the Cincinnati and Dayton wholesale areas. Paul C. Wilmore has been appointed branch manager with headquarters at 215 West Third Street, Cincinnati. Previously he had represented G. E. on the Pacific Coast with offices in San Francisco.

The St. Louis branch will cover the city's wholesale area and will be under the managership of G. R. Brownback, who has been on the staff of the G. E. office in Washington. His new headquarters will be at 500 North Beaumont Avenue, St. Louis.

A new G. E. factory-operated Newark Appliance Service Center has been established at 85 Main Street, West Orange, N. J. The Center will take over the service activities of appliances formerly handled by the Philip H. Harrison Company. The Harrison Company will continue as distributors of commercial refrigeration equipment.

The Newark Service Center will be managed by John H. Stubbs who, for the past six years, has been product manager for the Harrison Company.

ALLIS-CHALMERS ELECTIONS

The board of directors of Allis-Chalmers Manufacturing Co. of Milwaukee, has elected three new vice presidents. They are William C. Johnson, James M. White and William A. Roberts.

Mr. Johnson, who has been general sales manager, joined Allis-Chalmers in 1924. After serving in various district offices, he became sales manager of the crushing and cement division. Next, he was placed in charge of general sales in 1942, succeeding Walter Giest, who became president.

W. C. JOHNSON

Mr. White joined the organization in 1929 after graduating from the Alabama Polytechnical Institute. In 1934 he was made manager of the company's La Porte, Ind. works. He returned to Milwaukee in 1941 to become assistant general works manager and was elevated to works manager in April 1942.

Mr. Roberts went to Allis-Chalmers as a salesman, after varied experience as a road contractor and salesman. In June 1930, he became agricultural sales manager of the company's tractor division, and in 1941 he succeeded the late Harry C. Merritt as manager of the tractor division.

WESTINGHOUSE PERSONNEL CHANGES

Ellis L. Spray has been named assistant to the president of the Westinghouse Electric and Manufacturing Company, in charge of the Headquarters Manufacturing Division in Pittsburgh. He has been manager of the company's Merchant Marine Division at Lester, Pa.

Russell E. Ebersole has been appointed lamp sales manager of the Westinghouse Lamp Division. In his new position, Mr. Ebersole will have charge of all district sales activities of the Lamp Division and will make his headquarters at the Bloomfield plant.

R. E. EBERSOLE

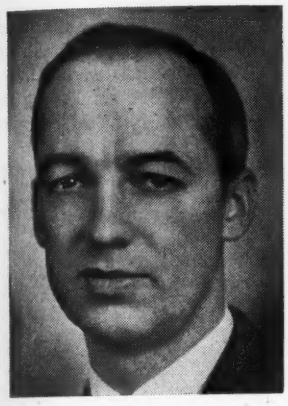
Hugh J. Hanbury has been named manager of the metropolitan New York area for the lamp division. Mr. Hanbury had been manager of the division's Newark area since 1938.

The appointment of Donald E. Jenkins as supervisor of industrial relations at the Cleveland Lighting Division has been announced. In 1935 he joined the Westinghouse Lighting Division in the sales negotiations division and two years later was transferred to the sales promotion department. In 1939 he was named manager of that department.

Walter J. Maytham, Jr., has been named industrial manager of the Northwestern District with headquarters in Chicago. Formerly manager of the Company's Petroleum, Chemical, Mining and Marine Section, Industrial

Division, Mr. Maytham succeeds R. L. Irvin, who has been named to a new post at the Westinghouse Lima plant.

William W. Sproul, Jr., has been appointed manager of the Application Department of the Sharon Works. He has been with Westinghouse since 1927. From 1937 until 1942 Mr. Sproul was in the Power Transformer Sales Section at Sharon and from 1942 until his new appointment he served as manager of the Transformer Equipment Section.



W. W. SPROUL, JR.

Grant Fitch, who has been head of the Ishpeming, Mich., office has been transferred to the Milwaukee office. Pending the appointment of a successor at Ishpeming, Mr. Fitch will continue to serve his customers in the Michigan Upper Peninsula in addition to taking over responsibilities at his new headquarters in Milwaukee. Meantime the Westinghouse office at Ishpeming will be closed.

W. E. Lee, who has served as an electrical application engineer at Los Angeles, Calif., for the past 10 months, has been appointed marine division representative in the Los Angeles area. He is succeeding E. W. Fullman, who has resigned to become sales engineer for Fafnir Bearings, Inc., in the Los Angeles area.

Russell L. Whitney has been appointed manager of the Agency and Specialties Division, Central District. Formerly sales manager of the company's Transformer Division at Sharon, Pa., Mr. Whitney succeeds H. E. Bracke, who has been named to a new post with the Westinghouse Electric Supply Co. in Detroit. Mr. Whitney will be located in Pittsburgh.

CUTLER-HAMMER CHANGES

Cutler-Hammer, Inc., Milwaukee, has named G. E. Hunt as acting manager of the Atlanta territory with offices and warehouse at 134 Marietta Street, N. W., in Atlanta, Ga. He was formerly manager of the Indianapolis Office.

Cutler-Hammer has established a new sales office in Columbus, Ohio. Russell D. Yoder is the sales engineer in charge of this new office located in the Chamber of Commerce Building, 30 East Broad St.

SYLVANIA APPOINTMENTS

Sylvania Electric Products, Inc., has opened a West Coast office at 111 Sutter Street, San Francisco. This office is in charge of B. K. Wickstrum,

B. K. WICKSTRUM

Pacific Coast Sales manager for the company's lighting products.

Sylvania recently opened offices in Los Angeles and Seattle, with G. W. Field as manager of the California Division which includes Nevada, Utah and Arizona and C. W. Dickinson as manager of the Northwest Division, assisting Mr. Wickstrum.

Charles H. Goddard, formerly vice president of the Pittsburgh Reflector

C. H. GODDARD

Company, has joined Sylvania as product manager, fluorescent fixture sales.

A graduate of Ohio University, Mr. Goddard gained his first experience in the lighting field with the Columbus Railway Power and Light Company. In 1931 he joined the reflector company. He is also vice-president of the east central region of the IES and is active on a number of War Production Board committees. Mr. Goddard will make his headquarters at the Sylvania fixture plant at Ipswich, Mass.

DELTA-STAR CHANGES

The Delta-Star Electric Company of Chicago has announced several organization changes.

C. S. Beattie, formerly manager of engineering, is now vice-president in charge of Production and Engineering. S. C. Killian, formerly Development and Research engineer, is now chief engineer.

Thor Fjellstedt is assistant chief engineer, and he was formerly a design engineer. Manfred Stene, formerly design engineer of the Control Section, is now Electrical Engineer. R. A. Sternaman, formerly design engineer of the Switch Mechanisms Section, is Mechanical Engineer.

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The Pennsylvania Transformer Company of Pittsburgh, Pa., announces the appointment of W. R. Swoish as sales manager. A graduate of Ohio State University in Electrical Engineering, Mr. Swoish has had wide experience

W. R. SWOISH

in the electrical industry. He was sales manager of both the Distribution Transformer Section and the Switchgear Division at Westinghouse, and was affiliated with the Roller-Smith Company as sales manager from 1939 to 1943. Mr. Swoish spent a short time in the Cleveland office of Allis-Chalmers before joining the Pennsylvania Transformer Company.

Mr. Swoish's new headquarters will be at the company's main offices in Pittsburgh.

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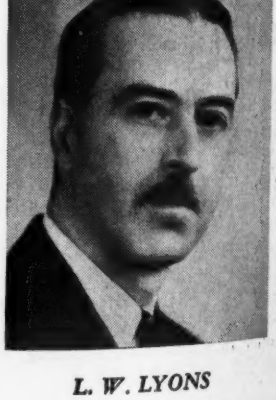
The Colonial Lighting Division of the Colonial Neon Company, Inc., North Bergen, N. J., has named Lester W. Lyons as sales manager in charge of the Lighting Division.

Mr. Lyons is well known in the lighting industry nationally. He organ-



L. W. LYONS

ized and directed the Illuminating Engineering Bureau for the Brooklyn Edison Company from 1923 to 1928. Early in 1929 he became affiliated with the Silvray Lighting, Inc., as a member of its engineering staff and was promoted to sales manager in 1932, which position he held until late 1942. At that time he requested a leave of absence to join the Radio Division of the Western Electric Company.

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The H. H. Robertson Company of Pittsburgh, Pa., has announced the appointment of Arthur W. Hedgren as its general manager of sales, succeeding Fordham C. Russell, who is

A. W. HEDGREN

now a member of the firm of Fuller, Smith & Ross, Inc., of Cleveland.

Mr. Hedgren joined the Robertson organization 21 years ago. Until his promotion to general manager of sales, he was manager of Q-Floor sales and previous to that he was Chicago district sales manager.

•

Commercial Control & Device, Inc., of Brooklyn, N. Y., has changed its corporate name to General Switch Corp. The officers, personnel, products and services remain unchanged. The present officers of the corporation are M. S. Muller, president; A. G. Muller, vice president and W. H. Ross, secretary and treasurer.

•

Monitor Controller Co., Baltimore, Md., has appointed Robert S. Durling as director of Industrial Relations. He was formerly purchasing director for this company.

Robert Jordan has been named purchasing director, to succeed Mr. Durling.

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A. L. Smith Iron Company of Chelsea, Mass., has named J. H. Brundage as Metropolitan district manager of its New York office, which is located at 6 East 45th Street. This office will con-

trol sales in Metropolitan New York, lower New York State, Long Island, State of Connecticut and Springfield, Mass. Mr. Brundage has been associated with the lighting industry for many years, and for the past eight years he has been district lighting specialist in charge of Lighting Equipment Sales for the General Electric Supply Corp. in New York City.

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The Bright Light Reflector Company, Inc., Brooklyn, N. Y., announces the appointment of Charles E. Scholl as general sales manager. Mr. Scholl has

C. E. SCHOLL

been with Bright Light since 1935 and for the past five years he has acted as manager of its Engineering Division. He will operate from the factory and executive offices in Brooklyn.

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Two divisions of American Industries Management Company, Chicago, have opened New York Branch offices at 101 Park Avenue. **Schwarze Electric Company,** Adrian, Mich., has named B. L. Clegg, formerly of Westinghouse Electric Company, as branch manager. **Stanley & Patterson, Inc.,** also of Adrian, has appointed Eugene Sullivan as manager of its New York Branch.

PRACTICALLY NEIGHBORS at 100 miles distance are contractors R. L. Fritz (left) Luverne, Minn., and O. H. Shade, Mitchell, South Dakota. Both attended N.C.E.I. War Conference at St. Paul.

Fifty Years of Safety Service

[FROM PAGE 57]

to factories producing UL approved products.

Operating as a non-profit organization—support being derived wholly from fees, at cost, paid by manufacturers for testing and inspection of their products—Underwriters Laboratories offers a unique safety service to the public. Products of any manufacturer are tested to determine compliance with UL's own standards relating to safety to life and property from fire, accident and other hazards.

The extent of the Laboratories' activities is represented by the 175 published standards (55 of which are electrical compared to 12 electrical in 1917) plus additional tentative requirements, each covering a group or family of products; by the 375,000 UL approved products now on the market, with electrical ones ranging from motor driven tooth brushes to heavy industrial equipment; and by the fact that their engineers are specialists in the fire protection, hydraulic, gases and oils, chemical, electrical, casualty and automotive and burglary protection fields.

For the past two years the Laboratories have been engaged in practically 100 percent war work. The armed services and governmental agencies have leaned heavily upon the talents and facilities of the Laboratories for research in finding suitable substitutes for critical materials, special investigations of problems and products, demonstrations and lectures on safety inspection, fire prevention, sabotage prevention and detection, safe handling of explosives and many other activities.

And so the Underwriters' Laboratories continues its activities in the interests of safety. As it has in the past, it will play a vital part in the postwar era with the development of safety standards for the new devices, new materials, and new techniques that are certain to come. No one can say how much property or how many lives have been saved due to UL tests and research, since records do not indicate potential losses that never occurred. One fact, however, is salient—behind the UL label stands the most grueling tests a piece of equipment could undergo. It is an assurance that the device will stand the gaff if used within the limitations of the manufacturer's specifications. Backed by such safety standards the electrical industry will progress.

NISA War Conference Report

[FROM PAGE 47]

methods to evaluate the economical features of the systems recommended. Highlighting portions of their new book "Bookkeeping Made Easy" they went on to explain continuous invoicing, bookkeeping and payroll techniques and other office shortcuts.

Materials and Equipment

Discussing the application of synthetic insulated (vinyl acetal) magnet wire, J. J. Curtin, assistant manager sales, Magnet Wire Section, General Electric Co., Fort Wayne, Ind., cautioned shopmen about "solvent-crazing"—the formation of hair-like surface cracks when the wire is immersed or wetted while the insulating film is under tension. Mr. Curtin made suggestions for preventing this action and continued with a detailed discussion of the application of varnishes on motors wound with synthetic insulated magnet wire.

Cooperative action on the part of the manufacturer and his service representative is important, stated J. M. Chandlee, service manager, Century Electric Co., St. Louis, Mo. Information from service shops enables the manufacturer to improve his product, remedy defects and eliminate the "bugs" that may develop in the field, he continued. Mr. Chandlee sees the possibility of motor shops servicing sealed-in refrigeration units in the future and feels that manufacturers should acquaint their service shops with the characteristics of special motors and equipment.

Many of those present received an initial lesson in electronics when H. C. Jenks, consulting and application engineer, Westinghouse Electric and Mfg. Co., Cincinnati, presented the technical motion picture "Electronics at Work"—explaining the theory and application of electronic devices in industry. Motor shops will undoubtedly encounter much electronic control equipment in the future.

Shop men spent the between-session hours visiting the various equipment display booths at the conference. Exhibits included coil winding equipment, testing equipment, shop tools and accessories, undercutters, insulations, bake ovens and sand blast equipment, and equipment and materials employed in office short cuts.

Important changes in the dues and administrative structures were approved at the business sessions. To eliminate unpopular assessments, the minimum dues was raised slightly with the rate based on a graduated scale depending upon the number of men in the shop.

The change in the administrative structure was decided on the basis of the present membership of over 600 spread over the entire U.S. and parts of Canada. Believing the present 9-member Board of Directors inadequate to thoroughly represent all sections of the country, the officers, Board of Directors and Resolutions Committee proposed a five point administrative change which was adopted by resolution. The proposed changes embody:

1. Expansion of the Board of Directors from 9 to 15 members.

2. Division of the United States into 15 regional areas—each constituting a natural area with approximately 1/15 of the membership. Each regional area elects one member to the Board of Directors by letter ballot.

3. The Board of Directors shall be of the 3-year rotating type. In 1945 each region elects one member to the Board (5 regions elect a member for a 1 year term; 5 regions for a 2-year term; and 5 regions for a 3-year term). Thereafter each region will elect one member for a three-year term.

4. No director who has served a 3-year term under this plan can succeed himself—until he has been out of office one year.

5. The Board as above elected shall elect officers of the Association from its own membership.

The resolution authorized the Board of Directors to perfect this plan and embody it into the By-Laws to become effective at the next annual meeting.

Officers elected for the 1944–45 term are: president, J. Arthur Turner, Tampa, Florida; vice president, Robert Turner, Canada; secretary, Wm. H. Braunlich, Pittsburgh, Pa.; treasurer, Selden F. High, Cincinnati. Directors elected for a 2-year term are: H. E. Grant, Nashville, Tenn.; and A. L. (Andy) Brown, Worcester, Mass.

Announcement was made at this session that the Award Committee had chosen Entries Nos. 12, 11 and 1 for first, second and third prizes respectively. Under the award rules, names of contestants are withheld from the award committee until winners are chosen. Names of the winners selected will be announced in the next NISA Bulletin.

Plan for Postwar Relations

[FROM PAGE 41]

for developing plans to provide adequate and stabilized employment in the reconversion of postwar period, particularly for returning servicemen and women.

The maximum possibilities for employment within our own trade and industry can only be realized if we can clear away trade problems which might otherwise hinder the sound development of postwar business. These problems are set forth in detail in other parts of this committee's report and we recommend that they be studied and given careful consideration by all those who are sincerely concerned with postwar employment and business development in the electrical industry.

It is only of relatively less importance that electrical contractors and dealers lend their utmost support to the business development plans and promotional programs of the electrical industry. We recommend that all members of the industry, including employees, lend their active support and cooperation to such plans and programs.

Employees have a stake equal to that of the employers in maintaining a sound economy under the American free enterprise system under which our nation has grown great and prosperous, and under which private industry has been able to contribute its astounding war production record toward the winning of World War II. Only the most wholehearted cooperation between employers and employees will help us to maintain high standards of compensation, and to play our part in avoiding wasteful government work projects and the otherwise inevitable relief lines, in the postwar period.

As desirable as any government or Social Security program is or may be, it is at best a poor substitute for individual opportunity and continuing effort for self improvement. A steady well-paying job is far more desirable than unemployment compensation. Thrift, with opportunity for sound dividend-paying investments is superior, or at least a comfortable supplement, to any program of old age assistance. Good health and protection from accidents beats any form of financial assistance to broken health or bones or missing eyes or limbs. Education and training for continued remunerative employment must supplement physical labor; this education should start in our high schools based on the electri-

cal code, as well as theory of electricity for apprentices, with added nightschool classes for convenience of those already employed or under the State Apprenticeship Training Program.

We believe that our industry should pay the highest possible compensation consistent with a sound national economy, but we must keep in mind that our ability to pay and to earn good compensation must bear a proper relation to the income of those who must pay for our services. There ought to be reasonable differentials for various classes of work so that our industry can serve each class of customer efficiently at prices they can afford to pay, and thus be induced to do business with us so that we can in turn maintain widespread and steady employment. Special ability should be recognized, while there ought to be due allowances for those who labor under handicaps and whose earnings must necessarily be less. Training programs should be initiated, or at least supported by the industry, to aid apprentices and those older employees who lack essential knowledge. Particular cooperation should be extended to war veterans individually, and in cooperation with all agencies charged with Veterans assistance and welfare.

We believe that employers and employees must recognize more than ever before that their individual welfare is a matter of mutual interdependence, and that their relationship with each other is threatened with deterioration rather than improvement by increasing governmental rules and regulations. We, as employers, must of necessity feel concerned with the welfare of our employees, and by making the employee more familiar with our problems gain their full confidence and cooperation for mutual progress and prosperity.

C. L. DAVIS, district OPA office, St. Paul, discusses Price Regulation 165 and recent amendments with Minnesota electrical contractors at recent N.C.E.I. Conference.

MOTORIZING gas engine driven washing machines and farm wiring are the specialties of contractors E. L. Muir (left) Jackson, Minn. and Emil Wiese, Lakefield, Minnesota.

Modern Lighting

[FROM PAGE 110]

ing units from the trusses and likewise called for a means of servicing and relamping.

Accordingly catwalks were placed at intervals, with a connecting catwalk at right angles to them all at one end of the building. The twin lighting units were suspended from hinged port openings in the catwalk at the proper spaced intervals. By lifting the catwalk port cover, access to the lighting units is obtained and relamping and cleaning can be done.

The parallel members supporting the catwalk were used to fasten the knobbed weatherproof slow-burning wire feeders for the lighting circuits along the catwalk. The transformer for each lamp was mounted on the truss alongside the catwalk.

In order to provide emergency lighting one branch circuit goes from the first lighting panel to a single lamp, the last in the circuit, through a holding coil which in turn controls the night lamp in the next lighting circuit branch panelboard, and again in turn that one to the next. This provides a string of lamps on a separate emergency circuit with a minimum of wiring and equipment.

Asbestos lined wooden duct risers are used instead of conduit to take the lighting circuits up to the catwalks, terminating in plywood pullboxes, also lined with asbestos which is glued on with what is known as an egg preserving compound. The only conduit used is that in the concrete floor. This is one inch electric metallic tubing and runs between precast concrete floor pits which are fitted with heavy laminated two by three covers. Panelboards are all floor mounted.

Power service comes in at 11 kv. to two unit substations with tailored

witchgear, located over the toilet rings of the building. It is transformed to 110/208 volts. The substations contain two 300-kva. transformers for the lighting, one for 440-volt power, all of which are pyranol filled.

Similar economy of materials is found in the wiring of an adjacent office building with knob and tube,

MODEL OF CATWALK and port to which twin lighting units were mounted. This method was adopted in lighting the large assembly plant building.

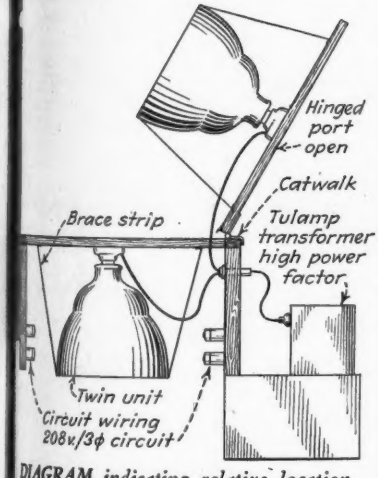

DIAGRAM indicating relative location of knobbed circuits, lighting units and transformer in respect to the catwalk.

using slow-burning weatherproof conductors to feed the fluorescent lighting fixtures. A cafeteria is similarly wired.

With a careful installation, good workmanship, proper spacing and adequate fireproofing where necessary, this large industrial job gives every assurance of long and satisfactory performance with the utmost minimum of steel and rubber and also of copper. Barth declares it is one of the most unusual industrial jobs his company has ever installed, one which war made necessary and possible.

SEARCHLIGHT SECTION

POSITION WANTED

ELECTRICAL SUPERINTENDENT estimator engineer, experienced industrial power plant and substation construction and design, and industrial plant maintenance, desires position. Will travel. PW-315, Electrical Contracting, 330 W. 42nd St., New York 18, N. Y.

Alphabetical Index to Advertisers

May, 1944

★ These companies have included Briefalogs, containing additional buying information on their products, in the 1944 edition of the Electrical Buyers' Reference.

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Type SNW Flamenol Wire added to Type SN completes Flamenol Building Wire line

This small diameter wire for use in wet locations is easy to install and can be depended upon to give good service. It is insulated with a thermo-plastic compound with low moisture absorption. It is approved by the Underwriters' as listed in the 1940 N.E.C., in sizes 14 to 4/0 inclusive for use in raceways in wet locations, viz:

1. Underground
2. In concrete slabs or masonry in direct contact with the earth
3. In wet locations
4. Where the condensation and accumulation of moisture within the raceway is likely to occur.

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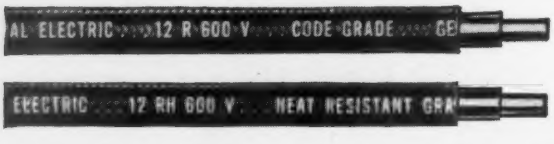
G-E BUILDING WIRES, TYPES R AND RH



G-E Type R, Code grade and Type RH, Heat Resistant grade building wires are also available. These building wires are insulated with synthetic rubber. They are carefully made and will give good service.

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FOR FURTHER INFORMATION on Flamenol Building Wire, Type SNW or Type SN, or on Code grade or Heat Resistant grade building wires or on conduits or wiring devices, see the nearest G-E Merchandise Distributor or write to Section CDW541-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

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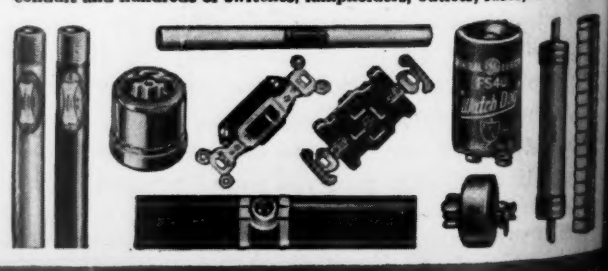

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